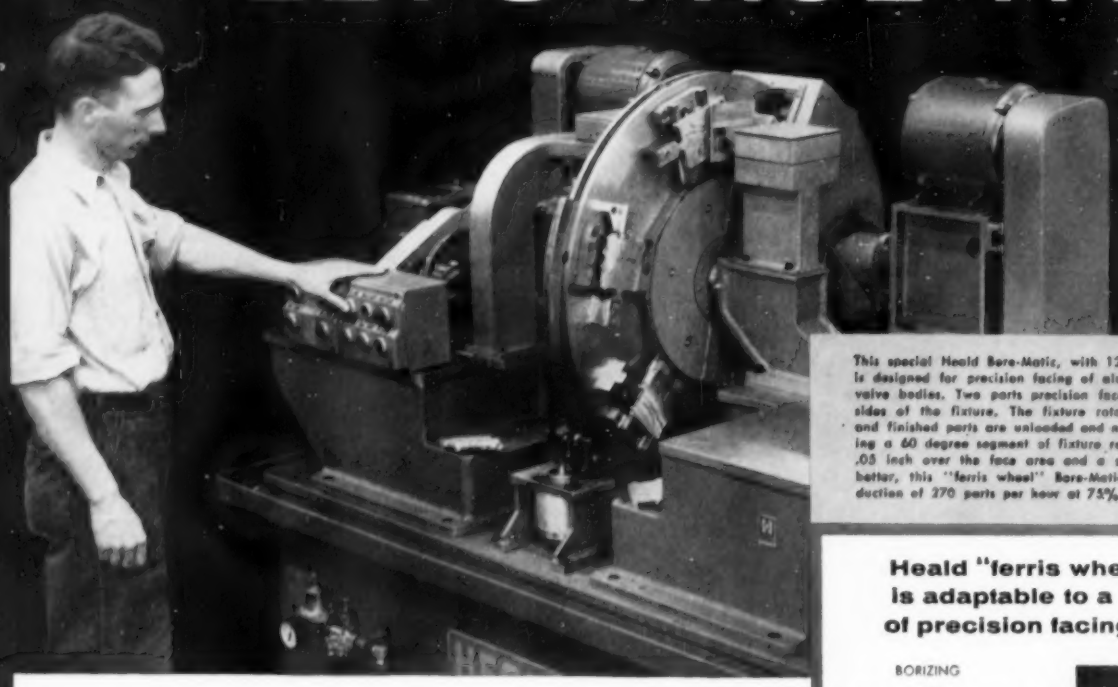
the TOOL ENGINEER

FEBRUARY 1957

stretch forming

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

LET'S FACE IT!



This special Heald Bore-Matic, with 12-station trunnion type fixture, is designed for precision facing of aluminum automatic transmission valve bodies. Two parts precision faced simultaneously on opposite sides of the fixture. The fixture rotates at approximately ½ rpm and finished parts are unloaded and new parts loaded manually during a 60 degree segment of fixture rotation. With stock removal of .05 inch over the face area and a surface finish of 20 micros or better, this "ferris wheel" Bore-Matic maintains a continuous production of 270 parts per hour at 75% efficiency.

Heald "Ferris Wheel" Bore-Matics put precision facing on a non-stop, high production basis . . . with loading and unloading "on the fly"

WHEN it comes to *precision facing*, Heald Borizing, with a "ferris wheel" type fixture, meets the most exacting requirements for both high production and high precision.

Designed for continuous operation, with non-stop loading and unloading, a multi-station rotating trunnion-type fixture carries the parts between two opposed boringheads which perform simultaneous facing operations on both sides of the fixture.

The loading and unloading are done while the fixture is rotating at a constant speed and can be accomplished easily by manual operation as in the photo above. A foot operated hydraulic clamping control leaves both hands free for this operation.

This specialized precision facing machine illustrates the extreme flexibility of Bore-Matic design and the ability of Heald engineering to solve your precision finishing problems with the most advanced production methods.

IT PAYS TO COME TO HEALD!

HEALD

THE HEALD MACHINE COMPANY

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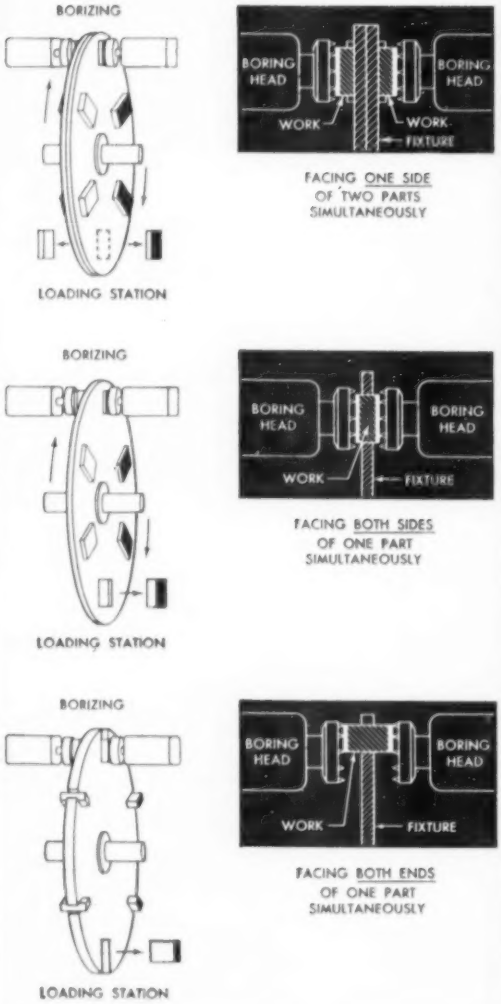
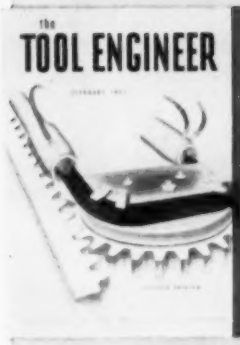
Heald "ferris wheel" Borizing is adaptable to a wide variety of precision facing operations.





Cover: Flange buckling is one of the major problems associated with contour forming. It is now possible to predict whether or not a flange of given design will buckle. A series of articles beginning on page 85 describes a method for calculating formability limits. When these limits are exceeded, buckling will occur.

The Tool Engineer

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PLANNING · ENGINEERING · CONTROL · TOOLING · EQUIPMENT · PRODUCTION

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*

1. Cures "stick-slip" or "jumpy table". When a table gets the "shakes", especially after it has just reversed or when the load is heavy and the speed slow, it's probably suffering from "stick-slip". Remedy—Sunoco Way Lubricant®. Special polar compounds in Sunoco Way Lubricant form a friction-reducing film that keeps a table sliding smoothly under all operating conditions.

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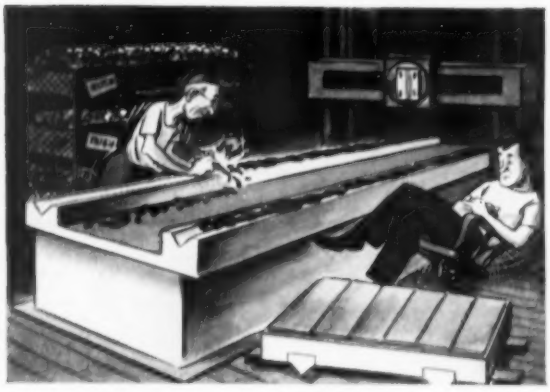

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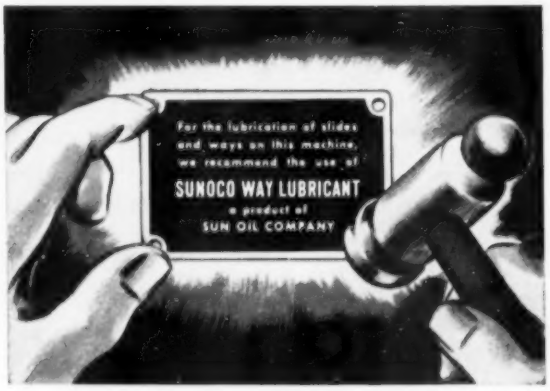
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The Tool Engineer

What Do Unions Offer?

More than ten percent of the nation's engineers have joined unions, delegating to others the responsibility of speaking for them and representing them in negotiations with management. Has dissatisfaction with their jobs caused them to take such a course? According to a recent survey conducted by the National Industrial Conference Board, that has been one of the major reasons. Has frustration resulted in this negative action? Why are engineers willing to trade professionalism for a temporary advantage?

These are questions to which management must seek the answers. To what extent is it responsible? Still more important is the need for each engineer to search his soul, facing his problems resolutely and without reservations for his own shortcomings. Engineering societies and universities also must supply information to both management and engineers on the alternatives.

In a 72-page report entitled, *Unionization Among American Engineers*, the Board concludes that engineers unionize because of dissatisfaction resulting from salary, insecurity attributable to "mass" employment and belief they are not part of the management team. These findings are based upon information from executives of companies whose engineers were unionized, officials of engineering unions and engineers themselves.

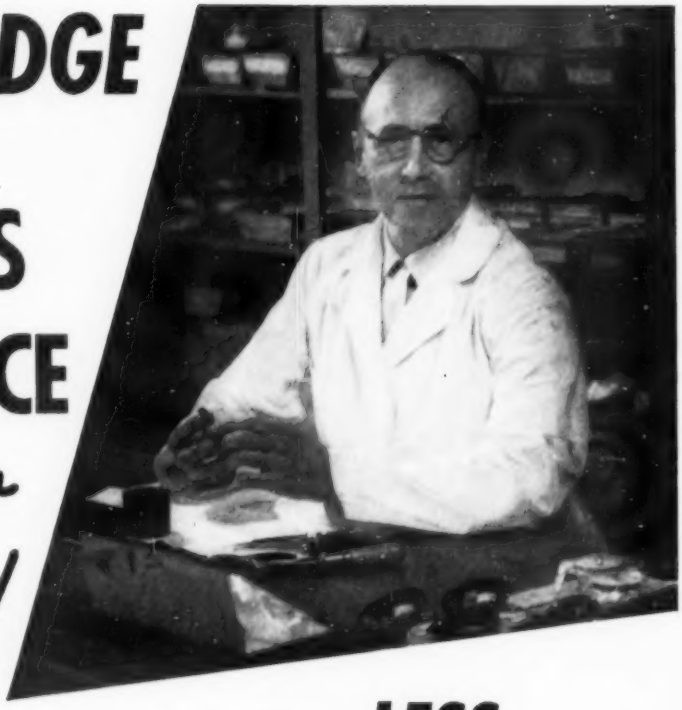
Engineers as well as industry had better wake up. Unions were not set up to handle professional personnel. Does an engineer desire to be a technician rather than a professional? Does he think only of what he can get, not what he can give? Does he expect professional recognition without the necessary sacrifices?

It is fuzzy thinking to believe that industry is getting too big for an individual to retain his identity. An engineer does not have to talk to the president. In small organizations that was and still is possible, but need that be the pattern of a large organization? If that is a cause for feeling insecure, management has failed in its organization and utilization of manpower. Still worse, the insecure engineer has a warped perspective of his job or has the wrong job. A working team between management and engineers is essential. They must work in an atmosphere of understanding so that they can contribute their best toward progress.

John W Greve

EDITOR

The BEST JUDGE of an INDICATOR'S PERFORMANCE is the *Man who Services it!*



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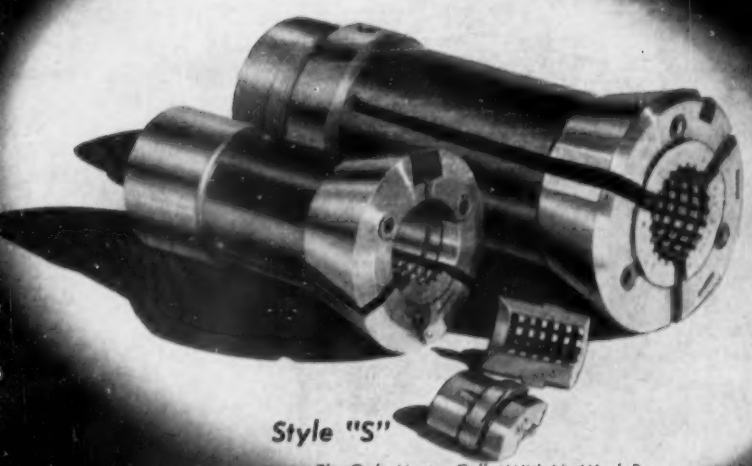

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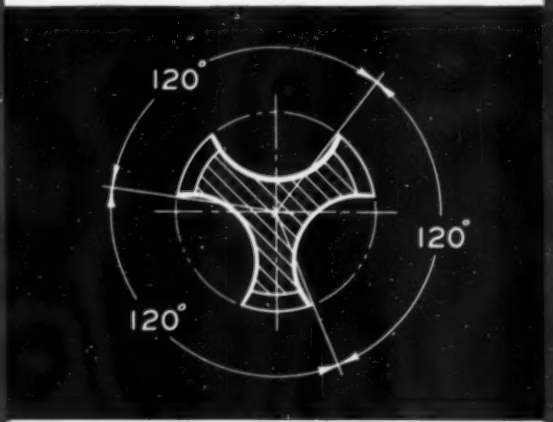

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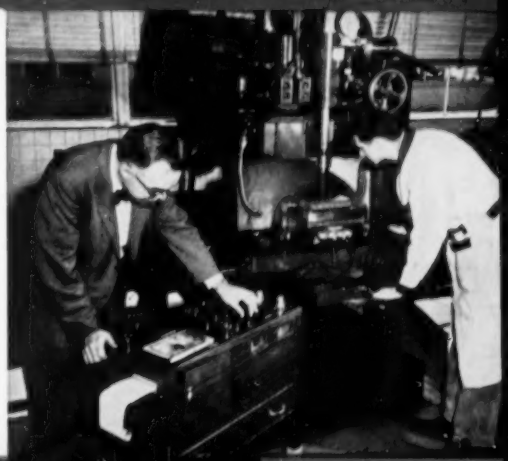

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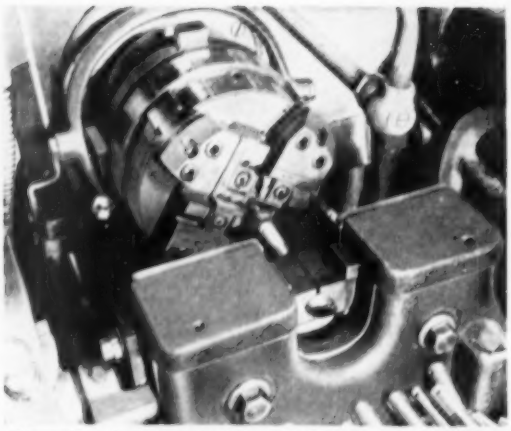

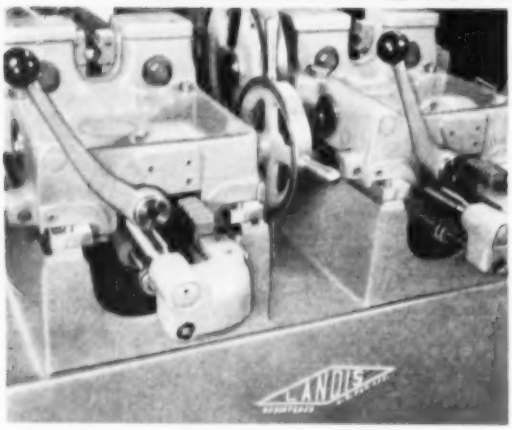

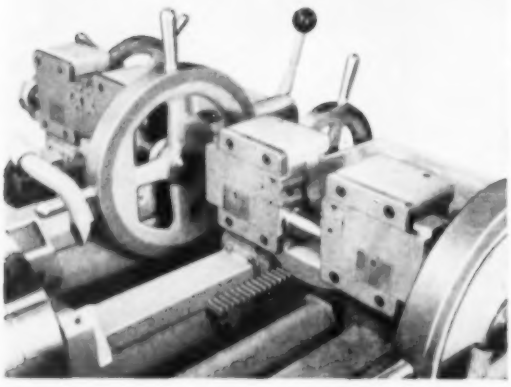

. . . are built in a wide variety of models for commercial, heavy duty, and precision threading from 3/16" to 2½" in diameter.

Single or double-spindle models are available in varying bed lengths, with or without lead screw, using either of two die head styles, according to individual requirements. The die heads use LANDIS Tangential Chasers, which may be reground for 80% of their original length. Adaptation for oversize capacity and special jobs is easily made through auxiliary equipment.

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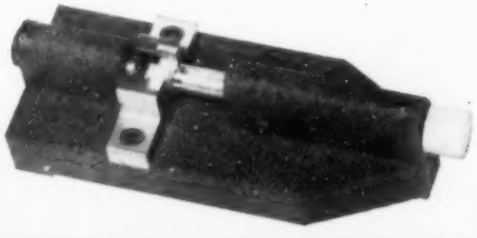

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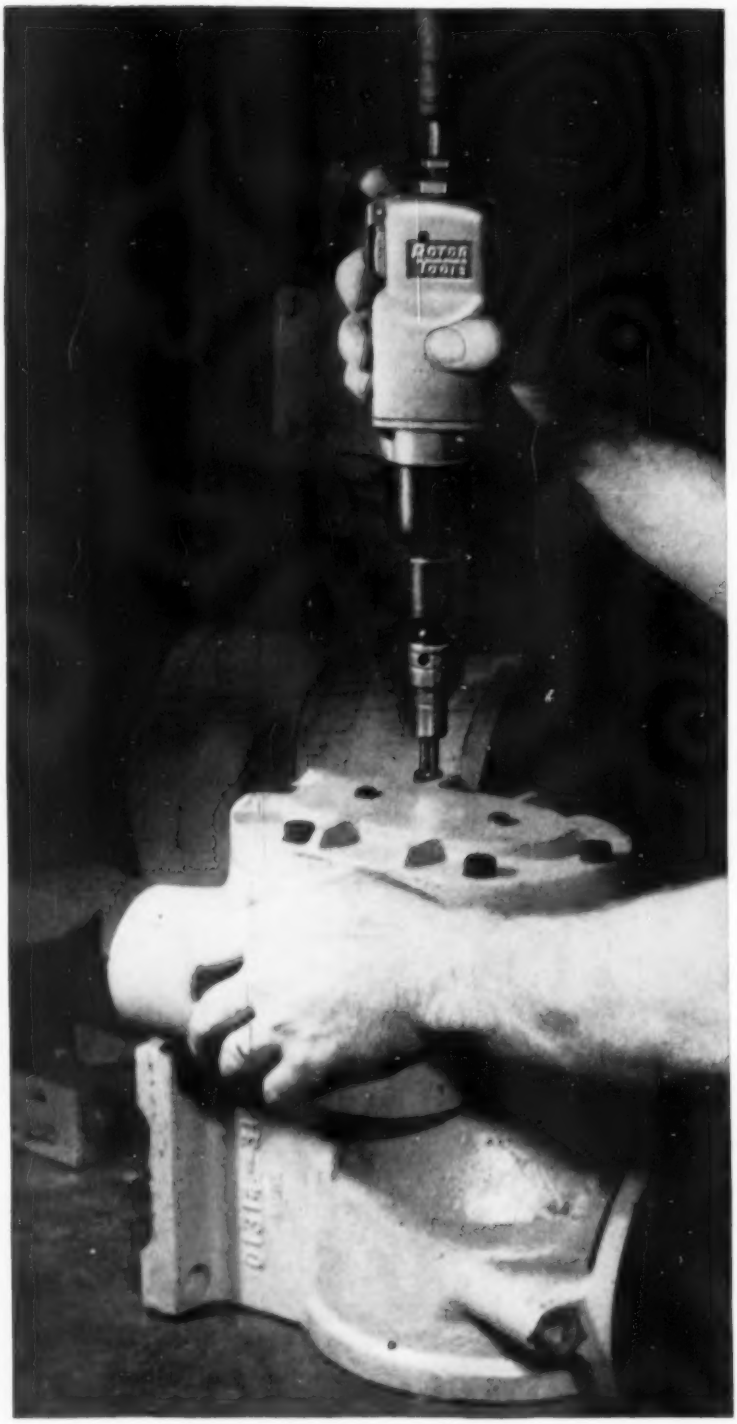

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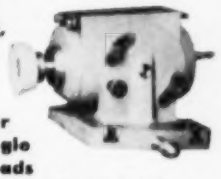

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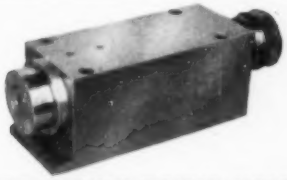

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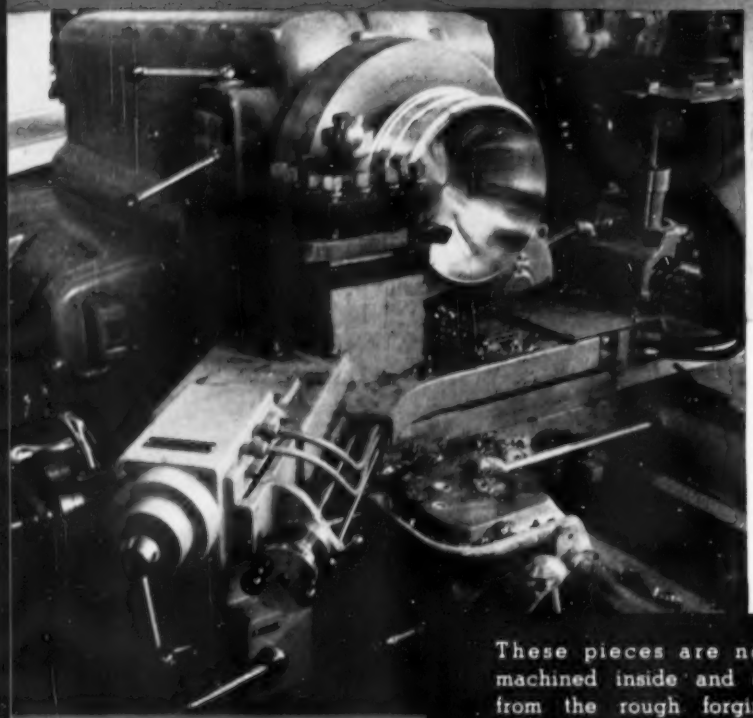

Machining the various contours of these guided missile components with the accuracy and finish required was a problem that Rheem Mfg. Co., Aircraft Division at Downey, California, had to lick.

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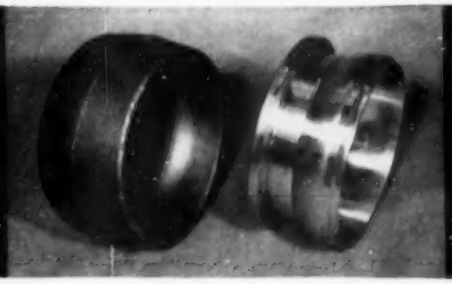

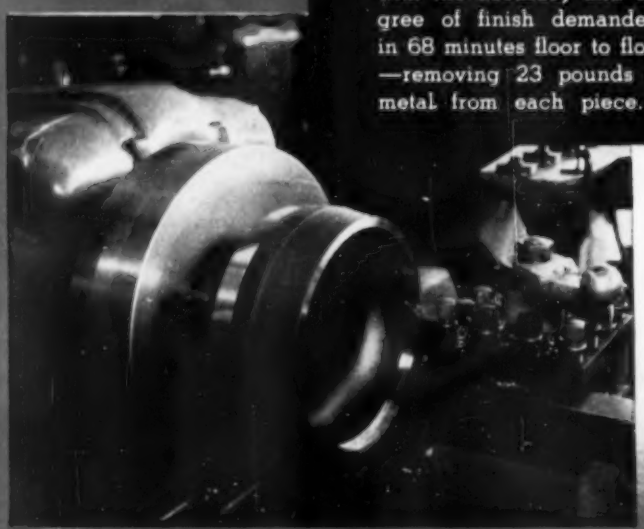

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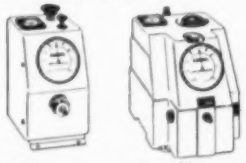
A new piping arrangement assures effective protection of the Air Meter from dirt, oil and water.

ONE THIRD SMALLER



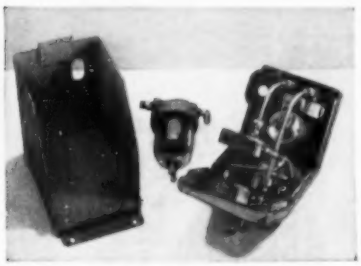
Compact, easy to handle — more adaptable for use on machine tools. Beautiful, dirt-resisting finish.

NEW IMPROVED REGULATOR (At Top)
A better and smaller regulator assures constant air pressure and enables a reduction in size of the complete gage. Setting can be locked to prevent accidental change of zero setting.

FINGER TIP ATTACHMENT OF GAGING UNITS
Knurled collar attaches all gaging units quickly: one hand only required. "O" Rings assure air-tight connection. No wrenches needed.

ONLY AIR GAGE WITH BUILT-IN ACCURACY THAT ENABLES USE OF ONE MASTER

BETTER FILTER with TRANSPARENT BOWL
New sintered bronze element filters out dirt and coagulated oil. Condition of air lines can be readily checked by observing filter bowl. Attached directly to gage, it eliminates extra piping.



ALL COMPONENTS EASILY ACCESSIBLE
One-piece top and front easily removed with all components and connections attached. Quick, easy servicing, if necessary.

DIMENSIONAIR

BASIC, NO-DRIFT SYSTEM

The Dimensionair system is basically sound in principle. Its accuracy is proved constant and dependable every day in practice.

However, no gage maker can control all the elements, human and technical, that influence the proper use of his product but he can incorporate features which tend to eliminate these faults and improve the actual use of his instruments.

That is the purpose of these new refinements which have been built into the Dimensionair.

Most air lines installed in plants were NEVER INTENDED to be used for precision instruments of any kind. Hence, the Dimensionair is now made EVEN MORE IMMUNE to unclean air and variations in air pressures.

Adjustments are more foolproof.

Smaller size makes the gage EASIER TO HANDLE and increases its adaptability for general use . . . and for multiple use.

Since any instrument is subject to all degrees of treatment it must be EASY TO SERVICE when the unusual or unexpected upsets its normal function. In the new and smaller Dimensionair all components and connections are quickly and easily accessible.

In every way the Dimensionair provides you with constant accuracy and GREATER DEPENDABILITY, adaptability and service. That's why more and more inspection people buy it. Why don't YOU try it? Write or call us at our nearest office.

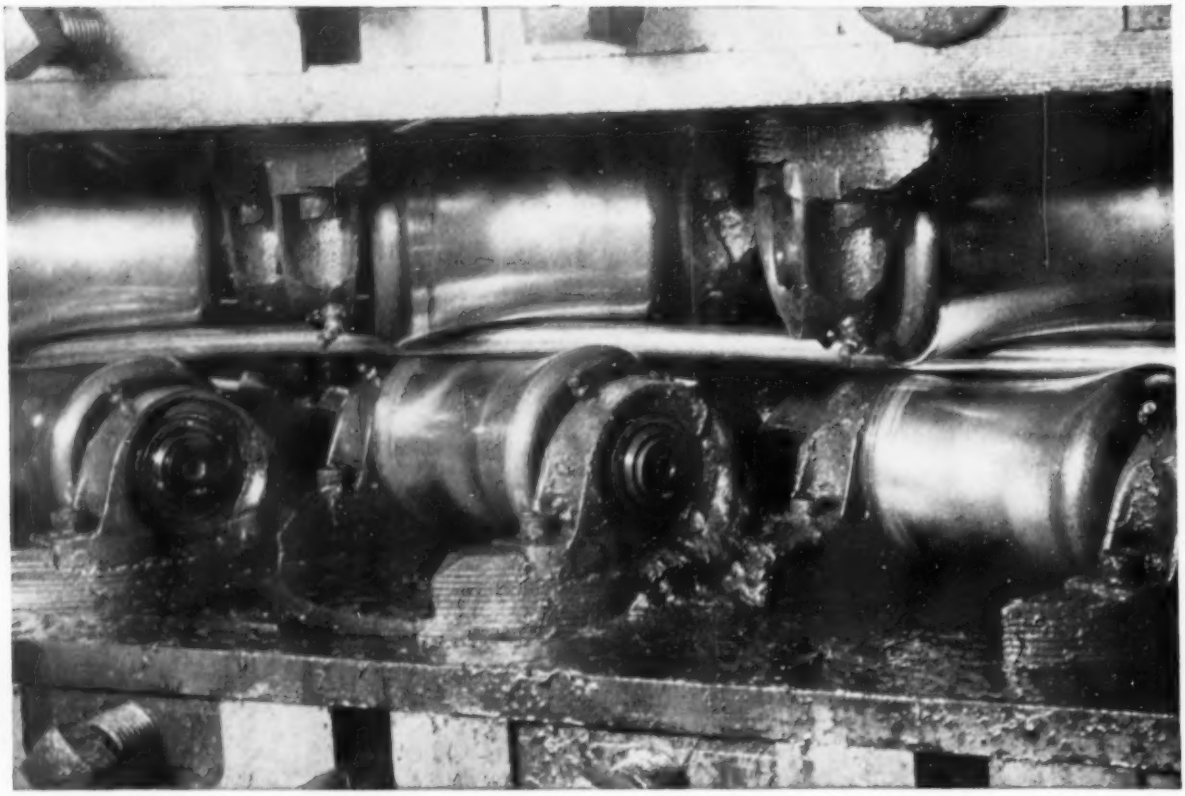
FEDERAL PRODUCTS CORPORATION
7192 EDDY STREET • PROVIDENCE 1, R. I.

Federal's solution to the cost of gaging:
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



Uses tool steel that outwears others 3 to 1 for its straightener rolls

TO help its customers get the longest possible life out of the rolls used in its small tube straighteners, Mackintosh-Hemphill Division of E. W. Bliss Co. makes them from Graph-Mo® steel.

Graph-Mo contains millions of tiny particles of diamond-hard carbides. As a result, users report it outwears other tool steels on an average of three to one!

Graph-Mo steel also contains free graphite which gives it outstanding anti-friction properties, prevents pick up and scoring. This is a big advantage to users of small Mack-Hemp straighteners because it results in a better surface on the products being processed. What's more it eliminates chrome plating the rolls, which is usually necessary when the straighteners are used for non-ferrous metals such as brass.

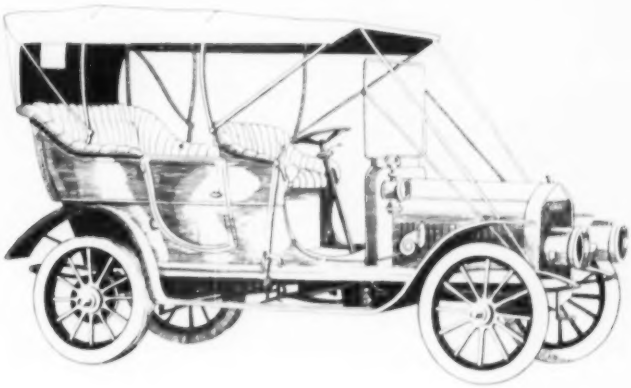
Graph-Mo steel gives Mackintosh-Hemphill two other important manufacturing advantages. It saves machining time because it's 30% easier to machine than ordinary tool steels. And it simplifies heat treating because of its uniform response to heat treatment.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. If you want more information about their use in dies, punches, gages and machine parts, write for the new Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

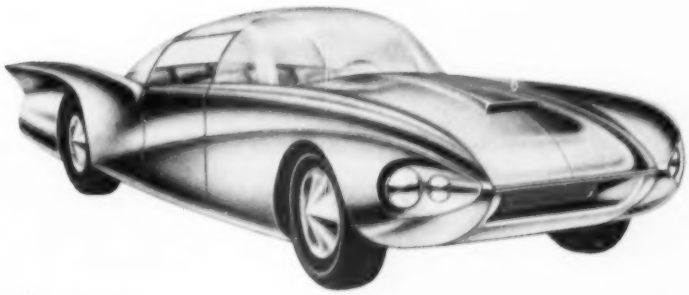
YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

Great in its day...



BUT WOULDN'T YOU
RATHER HAVE THE LATEST
TECHNICAL ADVANCE?



Heller announces a great

nucut

"Job Tempered" Hack Saws

Certified by American Standards Testing Bureau to meet their Standards for Superior Cutting: Uniform Teeth . . . Uniform Set . . . Uniform Temper.*

An exciting development in the tool field has been achieved by Heller with the perfection of JOB TEMPERING. This significant new advance in tool metallurgy and heat treatment has now been applied to a great new line of Heller Tools!

Developed after long metallurgical research and based on years of experience in producing superior metalworking tools . . . JOB TEMPERING results in tools that perform better and longer on the toughest jobs in the shop.

As a result, every Heller Hack Saw Blade is certified by American Standards Testing Bureau* to meet the three important requirements for superior cutting on the job: *Uniform Teeth, Uniform Set* and *Uniform Temper.*

Heller offers a complete line of JOB TEMPERED hack saws for both hand frame and power machine use.

Hand Blades:

Available in standard steel, high speed "M"-HAX and high speed "T"-HAX. All-Hard or Flexible Hard-Edge. Furnished in all standard lengths and tooth spacings. Packed in lots of 100 in attractively designed package.

Power Blades:

Available in high speed "M"-HAX, high speed "T"-HAX and shatterproof "NUWELD". Full range of sizes, widths, and tooth spacings. Packed in lots of 10 blades in an attractive newly designed package.

Give us your toughest hack sawing problem.

We'll be glad to show you how the remarkable new Heller JOB TEMPERED Blades can solve it efficiently and economically — delivering fast, straight, trouble-free cutting over longer periods.

HELLER TOOL CO. SINCE 1894

Heller

A GREAT NEW ADVANCE
IN TOOL TECHNOLOGY
BY

Heller...

"Job Tempered"

Tools

new advance in its too

nucut

"Job Tempered"

Metal Cutting Band Saw Blades

Certified by American Standards Testing Bureau to meet their Standards for Superior Cutting: Uniform Teeth . . . Uniform Set . . . Uniform Temper.*

The fundamental advance in hack saw manufacture made possible by Heller's JOB TEMPERING process has also been applied to a complete new line of Heller Metal Cutting Band Saws.

Special, controlled-analysis steel and Heller's unique heat-treating formula are combined with precision tooth contour and uniform set. The result: band saw blades that provide superior cutting and longer service on the toughest jobs.

Heller JOB TEMPERED Hard-Edge Blades are offered in all tooth shapes . . . Standard, (Regular or Wavy Set), Skip and Hook Tooth designs. High Speed Steel band saw blades are also furnished for specific applications.

Saws are available in all standard widths and tooth spacings . . . in 100′ and 250′ coils *or* welded to exact machine length ready to use.

Give us your toughest band sawing problem.

We'll be glad to show you how the *right* Heller JOB TEMPERED Blade will solve it efficiently, economically and give you faster, smoother cutting and longer life.

Here are the facts!

Heller's Catalogs on Hack Saw and Metal Cutting Band Saw Blades contain full information on types, sizes, widths and thicknesses of saws, tooth shapes and sets, types of steel, etc., that will help you solve your cutting problems. WRITE TODAY FOR YOUR FREE COPIES.

* AMERICAN STANDARDS TESTING BUREAU INC. — S TB

Tool Co.

AMERICA'S OLDEST FILE MANUFACTURER

NEWCOMERSTOWN, OHIO

ool line...

nucut

"Job Tempered"

Flat Ground Die Steel

Oil and Air Hardening Types

The Analysis Recommended by Leading Consulting Metallurgists

The metallurgical research that produced Heller's exclusive JOB TEMPERING process for their full line of tools has resulted in the development of truly superior Flat Ground Die Steel.

Here is a die steel analysis recommended by leading consulting metallurgists. It has excellent machining characteristics before heat treating. And when tempered according to Heller's simple Heat Treating Instructions, results in a true JOB TEMPERED tool or die that will give superior performance on the job.

Heller Die Steel is available in both Oil Hardening and Air Hardening types, precision ground to a finish of 25-35 micro-inches with all decarburization and surface defects removed.

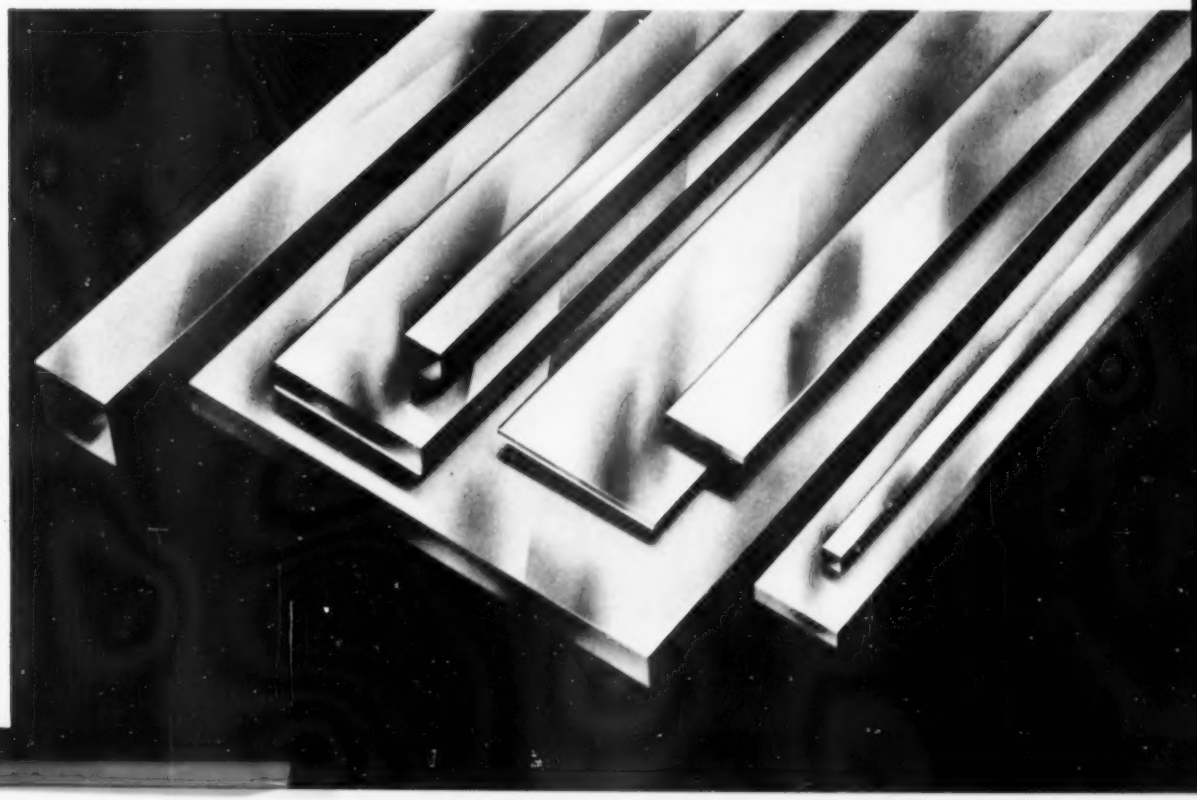
Oil Hardening type flats and squares are furnished in standard lengths of 18" and 36" and in a full selection of widths ranging from $\frac{1}{2}$" to 14" and from 1/64" to $1\frac{5}{8}$" thick. All sizes are individually packaged and include full heat treating instructions.

Air Hardening type flat and square sizes are available in standard 36" lengths only, in thicknesses from $\frac{1}{8}$" to 2", and in widths from 1" to 10". All sizes are individually packaged and include full heat treating instructions.

Special sizes of both types are also available on order.

Here are the facts!

Complete information on sizes, tolerances, chemical analysis and heat treatment is contained in this new Heller Nucut Flat Ground Die Steel Catalog. WRITE TODAY FOR YOUR FREE COPY.



NOW "Job Tempered"

NUCUT® AMERICAN PATTERN FILES WITH EXCLUSIVE "WAVY-TEETH"

AMERICAN-SWISS® SWISS PATTERN FILES

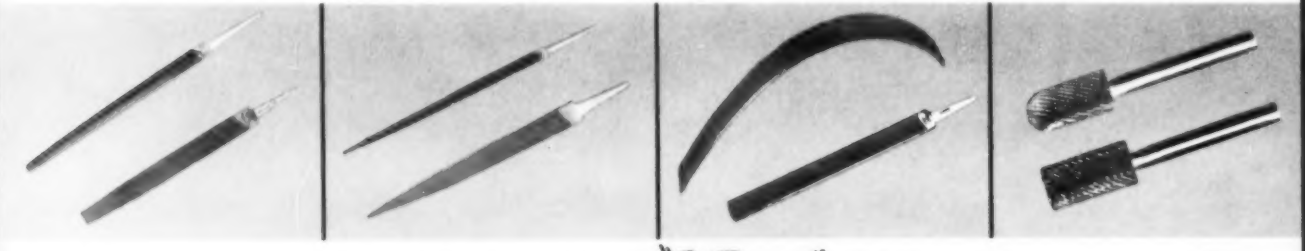
VIXEN® MILLED CURVED-TOOTH FILES

ROTARY FILES AND CARBIDE BURRS

Now Heller announces JOB TEMPERED FILES . . . the most significant forward step in file making since the development of Heller's exclusive "Wavy-Teeth" principle!

JOB TEMPERING combines the latest Heller metallurgical developments with special production techniques. The result of this new advance shows right up in *job performance* . . . superior cutting ability, better finish on the work and longer file life in the most severe service.

You'll get better results and cut your filing costs if you select the right file for the job from the famous Heller NUCUT American Pattern Files with exclusive "Wavy-Teeth"; AMERICAN-SWISS Swiss Pattern Files; VIXEN Milled Curved-Tooth Files; and HELLER Rotary Files and Burrs . . . and satisfy *all* your requirements for truly superior files.



A Complete Line of "Job Tempered" Files

NUCUT
American Pattern Files with exclusive "Wavy-Teeth"

AMERICAN-SWISS
Swiss Pattern Files

VIXEN
Milled Curved-Tooth Files

ROTARY FILES and CARBIDE BURRS

Here are the facts!

HELLER'S catalog gives full information on available types, sizes, cuts, shapes, and patterns. WRITE TODAY FOR YOUR FREE COPY!

SOLD EXCLUSIVELY THROUGH

Heller DISTRIBUTORS
"YOUR OUTSIDE TOOL ROOM"

Heller "Job Tempered" Tools

Heller Tool Co.

AMERICA'S OLDEST FILE MANUFACTURER

NEWCOMERSTOWN, OHIO

A Subsidiary of Simonds Saw and Steel Co.

A Head for Low-Cost Production

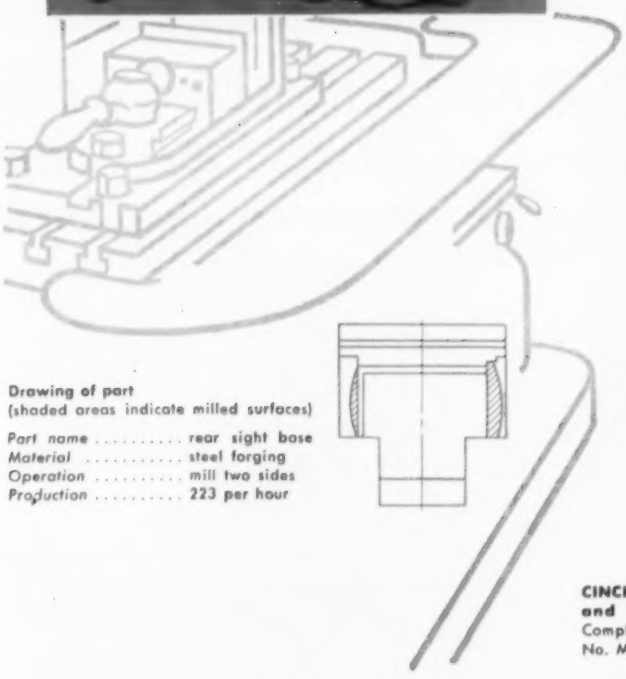
Duplex Head on Cincinnati 0-8 Plain Rise and Fall Mills an Extra Surface

This machine has a head for business. It's a CINCINNATI® No. 0-8 Plain Rise and Fall Milling Machine, equipped with a duplex head to mill **both sides** of small parts in **one cycle**, and **one handling** of the work.

> Production averages 223 parts per hour, about double what it would be without the Duplex Head. The drawing below indicates surfaces milled.

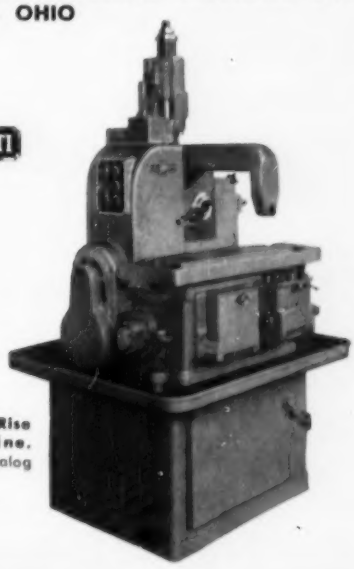
This equipment is the work of Cincinnati Application Engineers, a group of specialists who help metalworking industry reduce the cost of doing business. You can enlist their aid by sending blueprints and complete data on the parts which you suspect of being high-cost components. Meanwhile, you might like to know more about the highly productive 0-8 Milling Machines. Look in Sweet's Machine Tool File, or write for catalog No. M-1607-2.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



Drawing of part
(shaded areas indicate milled surfaces)

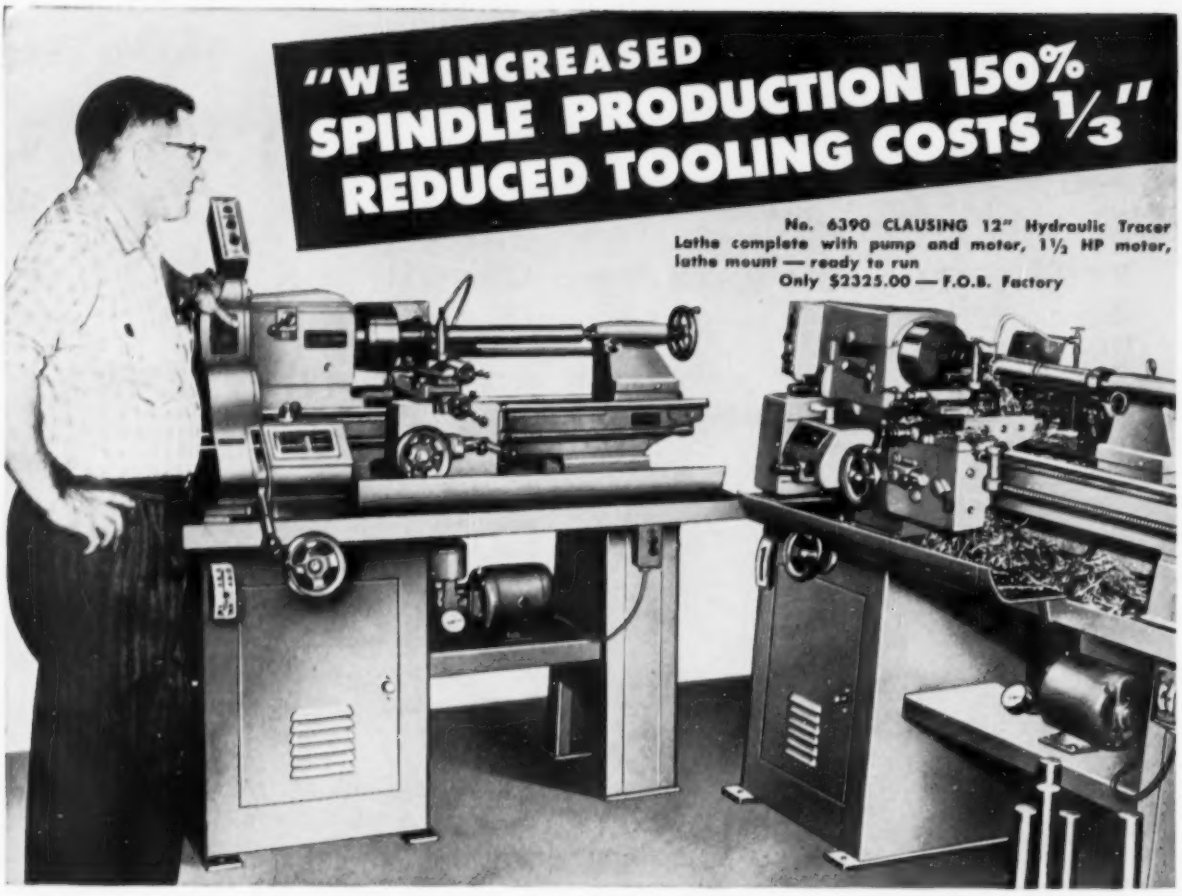
Part name ..... rear sight base
Material ..... steel forging
Operation ..... mill two sides
Production ..... 223 per hour



CINCINNATI No. 0-8 Plain Rise and Fall Milling Machine. Complete specifications in catalog No. M-1607-2.

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID


"WE INCREASED SPINDLE PRODUCTION 150% REDUCED TOOLING COSTS 1/3"
No. 6390 CLAUSING 12" Hydraulic Tracer Lathe complete with pump and motor, 1½ HP motor, lathe mount — ready to run
Only $2325.00 — F.O.B. Factory

NEW CLAUSING 12" HYDRAULIC TRACER LATHES

provide automatic duplicating of multiple diameters, tapers, bevels, shoulders, radii, grooves, chamfers.

The new Clausing 12" Hydraulic Tracer Lathe provides automatic reproduction, reducing to hours jobs that would otherwise require weeks or days. With this new CLAUSING you can . . . do automatic reproduction of intricate patterns • eliminate repetitive measurements, multiple tool set-ups, expensive forming tools • impart a smooth, stepless finish • provide automatic sizing • reduce chance for human error • practically eliminate scrap.

FOR SHORT RUN AS WELL AS VOLUME PRODUCTION – short runs can be done economically because set-up and tool changes can be made in minutes. Savings on long runs are phenomenal.

HANDLES WORK up to 12" diameter, 2½" diameter differential, 18" length. Hydraulic cylinder housed in Servo motor provides power to firmly drive and hold cutting tool. Slide feed, in and out, infinitely variable from 0 to 15" per minute. All critical parts of tracer unit hardened, ground and machine lapped.

FLAME HARDENED WAYS — VARIABLE SPEED DRIVE

Bed ways of lathe are flame hardened, ground. Variable speed drive from 43 to 222 and 250 to 1300 RPM, adjustable while running. Completely enclosed head stock, quick-change box, apron . . . oil bath lubrication. Spindle turns on big Timken "Zero-Precision" tapered roller bearings.

Write FOR ILLUSTRATED LITERATURE

Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY

CLAUSING DIVISION ATLAS PRESS COMPANY

2-114 N. PITCHER ST., KALAMAZOO, MICHIGAN

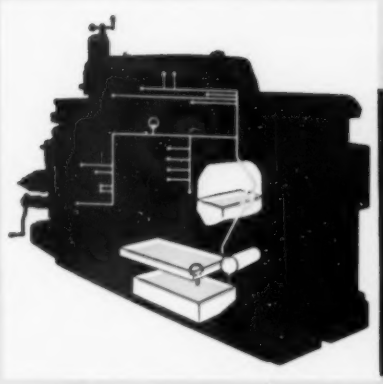
50 lbs. oil pressure

IS NECESSARY WITH A CUT LIKE THIS...

Demonstration cut on Cincinnati Rigid Shaper. Actual size steel chip, 2" cut, .030" feed.

This tremendous cut demonstrates the ability of the 50 p. s. i. lubrication system to develop and maintain oil films under the heaviest loads.

It also demonstrates the strength, rigidity and power which are standard features on all Cincinnati Rigid Shapers.



50 p.s.i. system includes 50 micro filter, settling basin and reservoir. Transmission runs submerged in oil.

• *Write* ***Department E*** *for Bulletin* **"Cincinnati Rigid Shapers"**

☆ The Electro-Magnetic Brake and Clutch with finger tip control are standard features on Cincinnati Shapers for maximum speed and ease of operation.

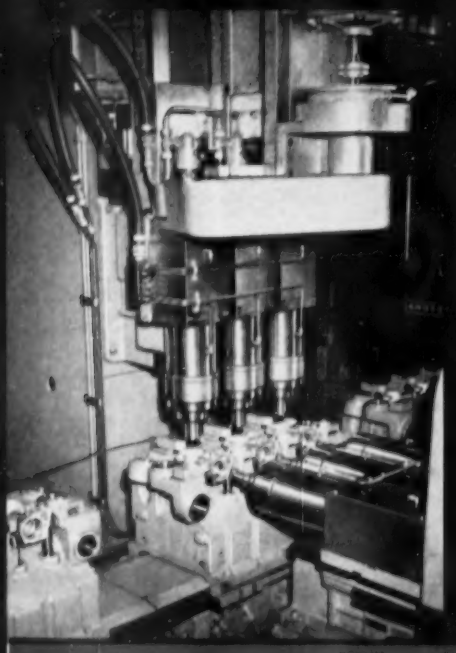
CINCINNATI

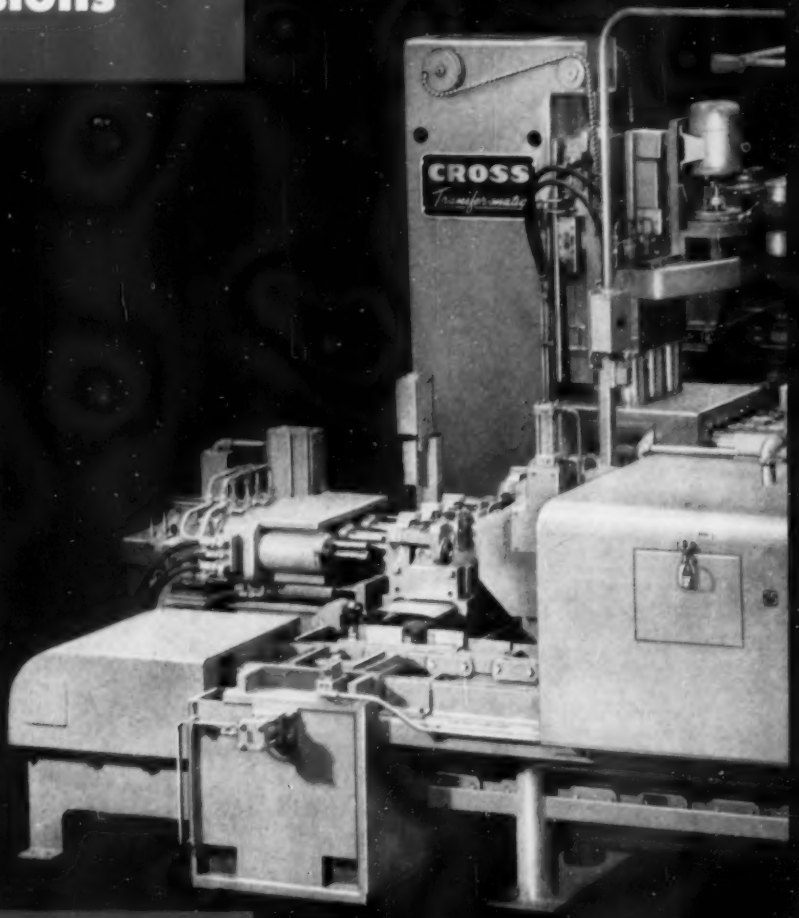
THE CINCINNATI SHAPER CO.

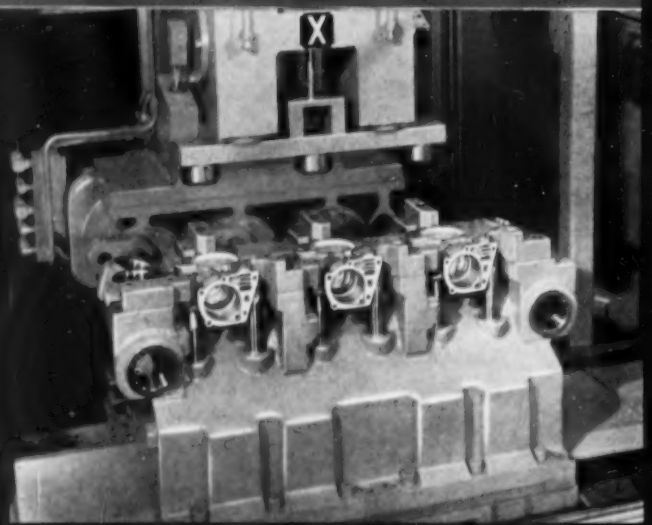
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Completely Machines Servo Valve Bodies for Automatic Transmissions

The final precision boring station.

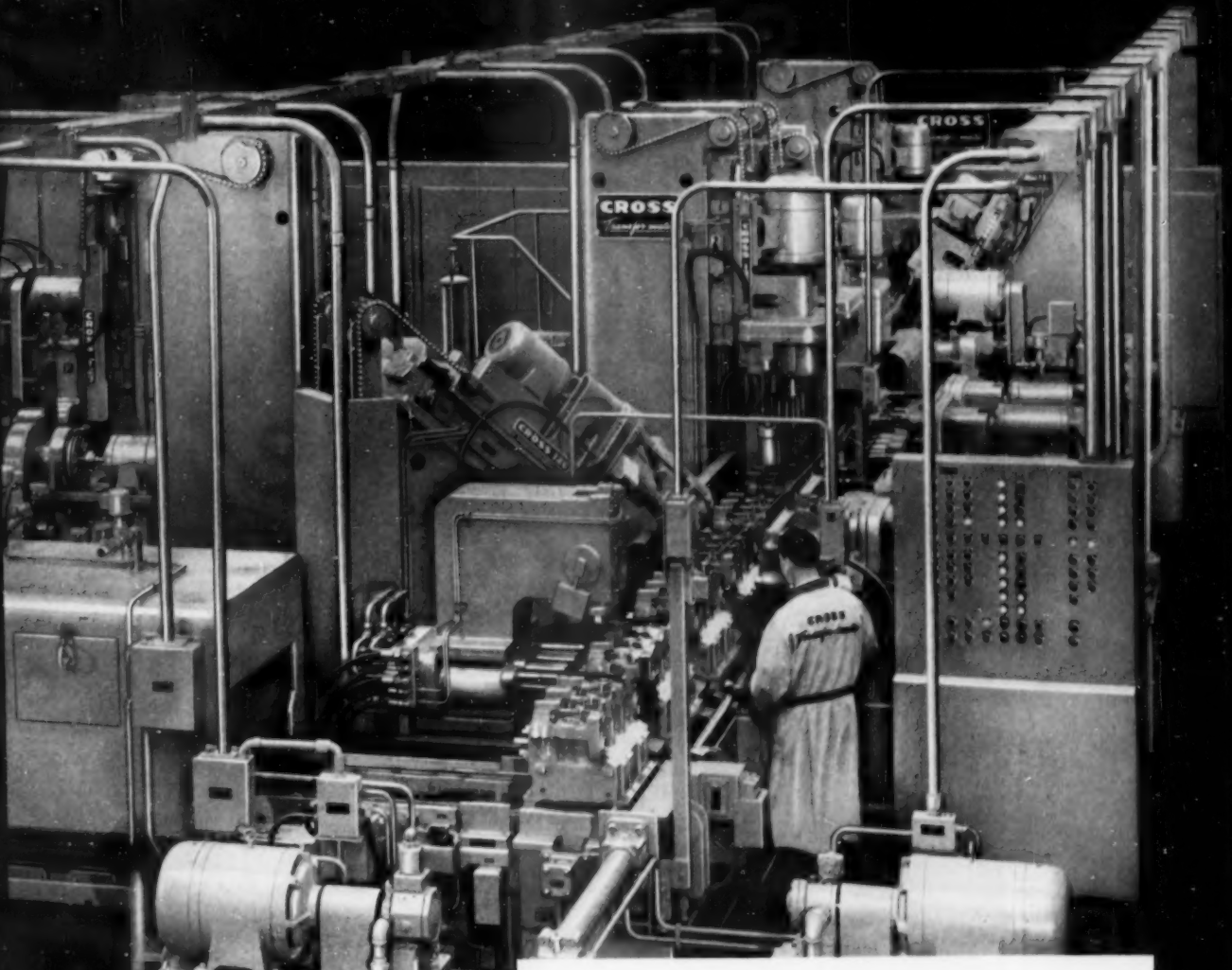






The loading station. Part locations are checked automatically by Unit X to assure proper clamping.

Another Transfer-matic by Cross



- ★ 21 drilling, 6 reaming, 5 tapping, 6 boring and 2 precision facing operations.
- ★ 490 pieces per hour at 100% efficiency.
- ★ 25 stations—1 loading, 1 unloading, 9 drilling, 1 tapping, 2 rough boring, 2 precision boring, 2 precision facing, 1 washing and 6 visual inspection.
- ★ Palletized work holding fixtures (each fixture carries three parts).
- ★ Unloading unit for removing parts from fixtures and placing them on conveyor.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ "Building Block" construction to provide flexibility for design changes.
- ★ Other features: automatic washing unit for fixtures; construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping.

Established 1898

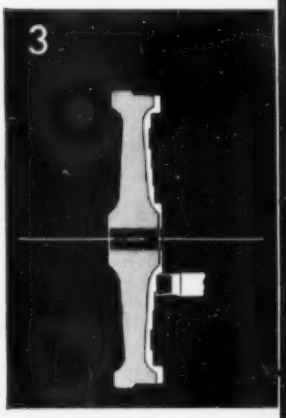
THE CROSS CO.

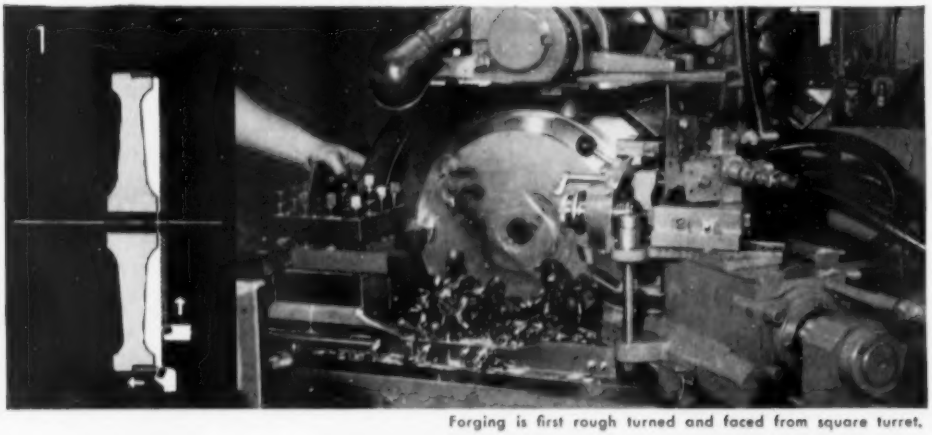
First in Automation

DETROIT 7, MICHIGAN

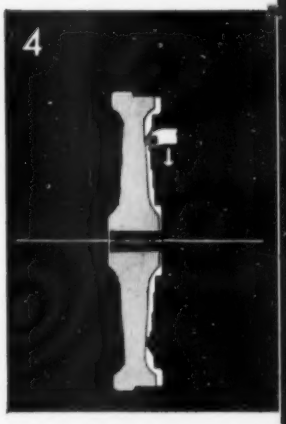
Ability of Warner & Swasey 2-A Contour solves turbine wheel face contouring

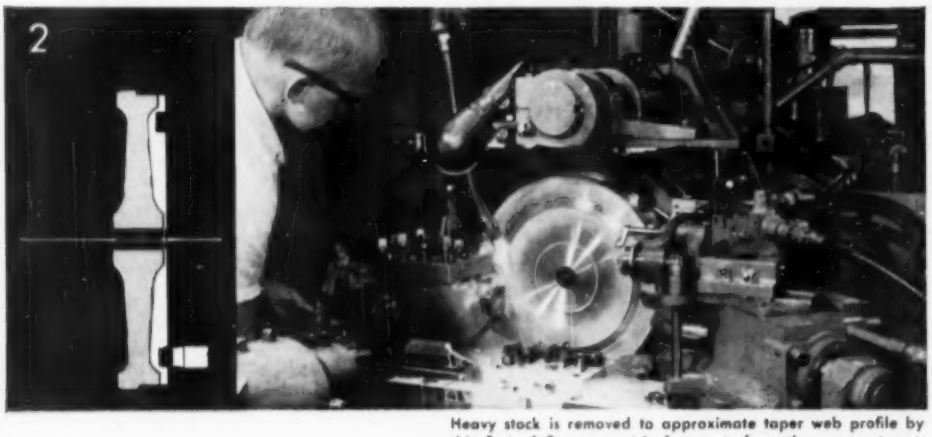
Typical turbine wheel produced on Warner & Swasey 2-A with Cross Slide Contour Attachment.



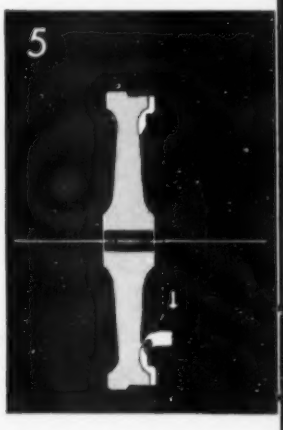


Forging is first rough turned and faced from square turret.

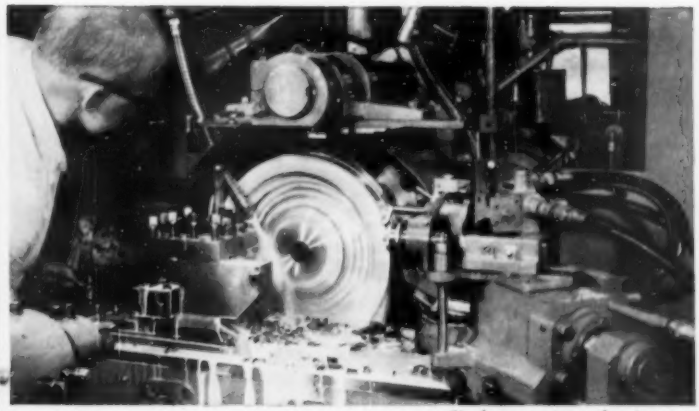




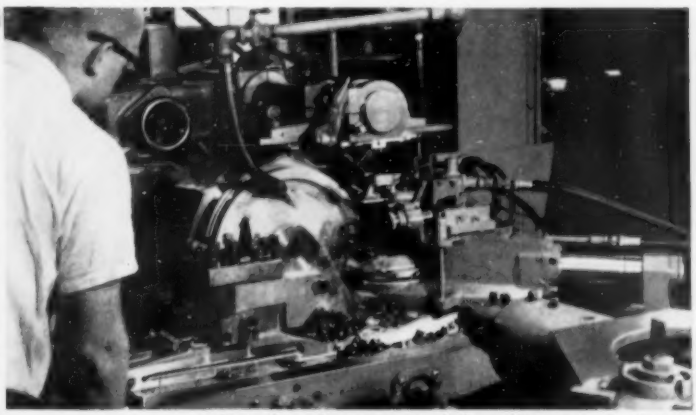
Heavy stock is removed to approximate taper web profile by this first of five concentric form cuts from the square turret.



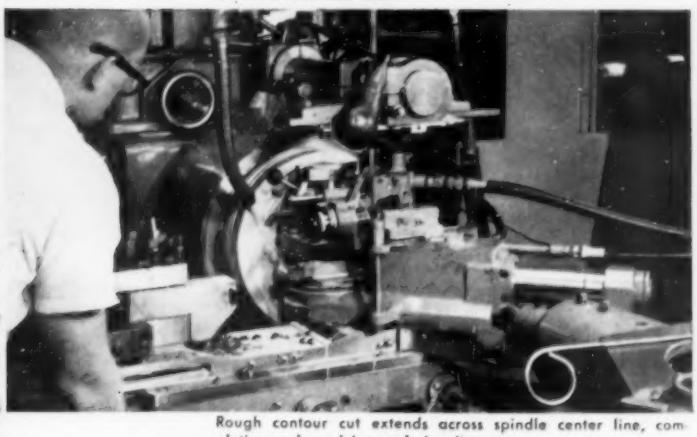
Unit to machine across center line... problem for Schellens-True Corporation



Final square turret forming cut.



Start of rough contour cut which machines part of web, hub diameter and hub face.



Rough contour cut extends across spindle center line, completing web and internal rim diameter.

Removal of over 80 pounds of metal from each side of a 250-pound alloy steel forging in 63 minutes called for the *only* turret lathe contouring attachment available today that could face across the spindle center line to machine inaccessible areas of the wheel's profile... a versatile Warner & Swasey.

Installation of a new Warner & Swasey 2-A Universal Turret Lathe with Cross Slide Contouring Attachment by Schellens-True Corp., Ivoryton, Conn., gave them the heavy-duty metal removal and machining flexibility necessary to mass-produce, by their own unique process, the turbine wheel shown at the left.

This progressive manufacturer, like many other enthusiastic users, reports their Warner & Swasey contouring equipment provides them:

- Fast, accurate contour turning and cross center facing in one unit
- Separate roughing and finishing contour cutters
- Longer effective cutter travel of 4 inches
- Instantaneous tool slide response
- Adjustable and accessible template mounting for using either round or flat templates
- No loss of turret lathe flexibility—normal turret lathe work still easily performed

Our Field Engineering Staff is always available to discuss how Warner & Swasey products can help improve work quality and build increased profits for you. Why not call today?

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

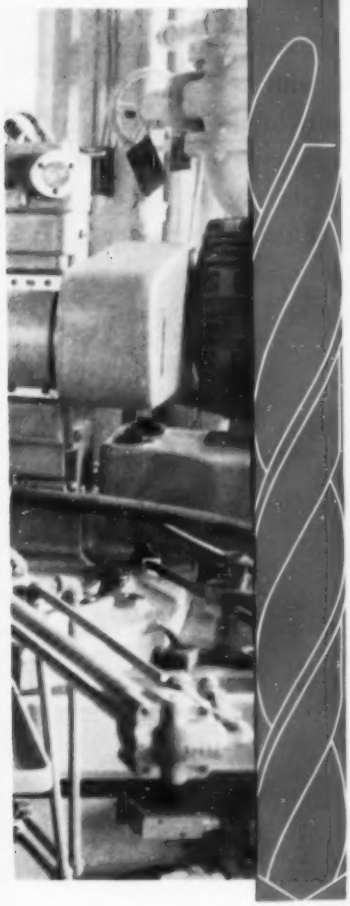
Another

NEW FLUTE GRINDERS ARE

Still another Reason why

Morse First

THE FIRST OF THEIR KIND...



Now grinding from the solid up to 1/2 inch

And, here's what it means to you:

★ Smoother finish . . . better than polished flutes!

★ Consistently held tolerances . . . never attained by milling!

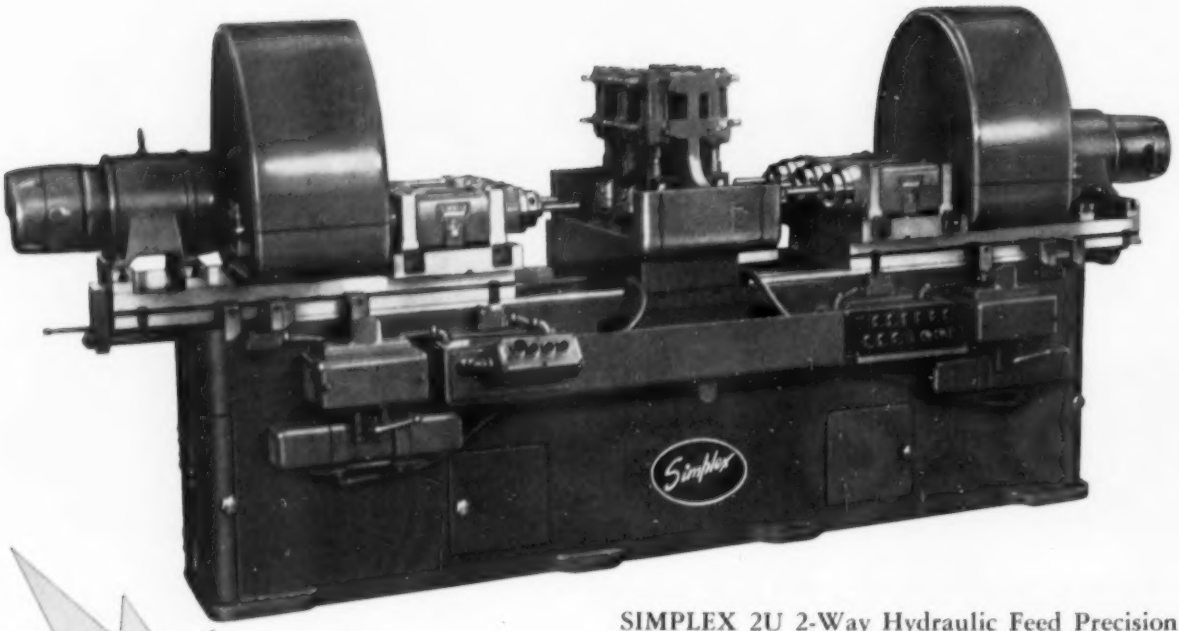
★ Better points . . . because of uniform flute depth!

★ Longer tool life . . . lower cost per hole!

This is why the new Morse flute ground drills are setting a new standard for quality . . . and, the only man who can show you is your Morse-Franchised Distributor.

MORSE TWIST DRILL & MACHINE COMPANY
New Bedford, Massachusetts
Subsidiary of VAN NORMAN INDUSTRIES, INC.
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco

MORSE means "THE MOST" in Cutting Tools



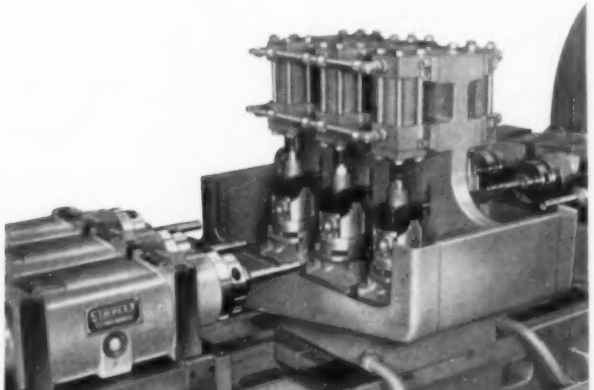
25 YEARS
1932 – 1957

Simplex

SIMPLEX 2U 2-Way Hydraulic Feed Precision Boring Machine complete with six #2 SIMPLEX self-contained automatically lubricated precision boring heads and a platen type work-holding fixture designed to hold six pistons for semi-finish and finish boring of the wrist pin holes. The electrical and hydraulic system on this machine is made to conform to J. I. C. Standards.

PRECISION BORING MACHINES

Hydraulically clamped type work-holding fixture designed to hold six pistons. The piston pin holes are semi-finish and finish bored at the rate of approximately 400 per hour at 100% efficiency.



SIMPLEX MACHINE TOOL CORPORATION

4528 WEST MITCHELL STREET

MILWAUKEE, WISCONSIN

PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES
SPECIAL DRILLING, TAPPING AND BORING MACHINES

PIPE MACHINERY paces future needs for you

Typical of the many ways Pipe Machinery Company gage design and developments reflect industry pioneering, is found in the fact that for more than four years Pipe Machinery Company's experienced craftsmen have been holding thread gages to tolerances now required for Drunken Thread.

This drunken thread specification will undoubtedly make many gages now in use obsolete — but this bonus of quality from pace-setting design and manufacture assures PMCo gage users continued use and high accuracy.

If you would like a catalog of our gages, write us on your Company letterhead.

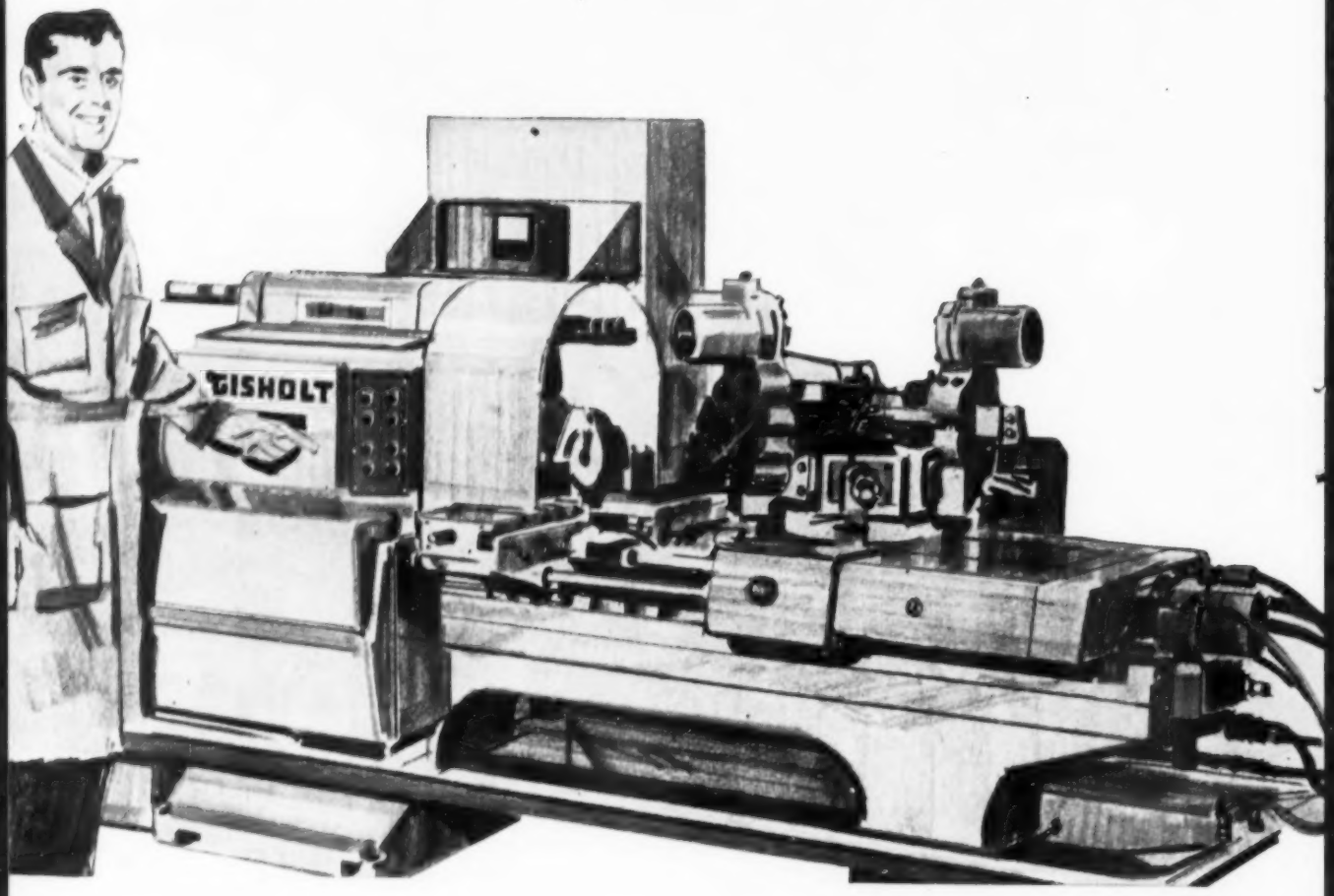
THE PIPE MACHINERY COMPANY

29101 LAKELAND BLVD. • WICKLIFFE, OHIO

Greater Cleveland

NEW Gisholt Fastermatic

CUTS YOUR SETUP TIME



GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

MASTERLINE
GISHOLT SINCE
1887

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

control panel

50% OR MORE

BY SIMPLY FLIPPING TOGGLE SWITCHES, your operators can cut automatic turret lathe setup time 50% or more with this electric setup control panel.

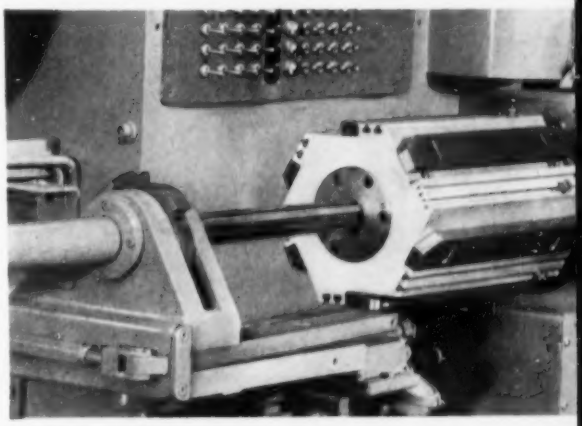
Thoroughly proved in production lines, this control panel is one of the many advanced features available on the new Gisholt MASTERLINE Fastermatic Automatic Turret Lathe.

Here's how the panel works: within finger-tip reach, your operator has a horizontal row of toggle switches for each face of the hexagon turret. By simply flipping the switches right or left, he pre-selects desired machine functions. Re-runs? Here the Fastermatic makes even more drastic cuts in setup time. A master reference card, made from the previous run, is used, and the machine is ready to go with absolute minimum preparation. Feed changes are fast and easy. Tool overhang is quickly minimized by re-positioning the saddle. Anywhere within the machine cycle, the operator can make a trial cut, withdraw the tools, mike the part, re-set the tools and resume forward feed.

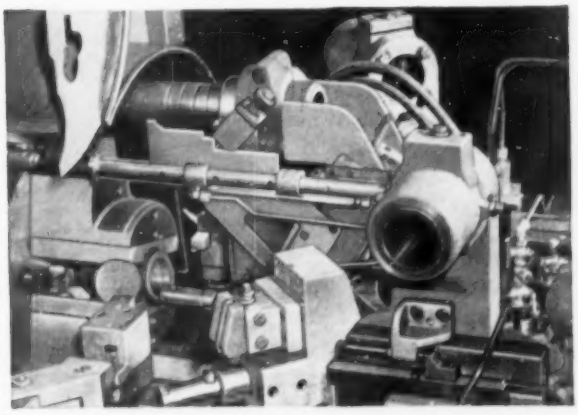
What does this versatility mean to your own operations? It means more time spent cutting chips and more profit per piece. It means that less skill is required of the operator and he is free to handle additional units or do other work during machining cycles. It means you can utilize smart tooling and eliminate human errors... get record production on long runs ...*and also get the advantages of automatic cycle operation on relatively short runs.*

Ask your Gisholt Representative to tell you about the Fastermatic's new electric control panel... its increased capacity... its higher speeds and feeds and heavier construction. You'll also want to know about using the Gisholt JETracer on the Fastermatic. Call him today—or write Gisholt for literature... ask for Bulletin No. 1179.

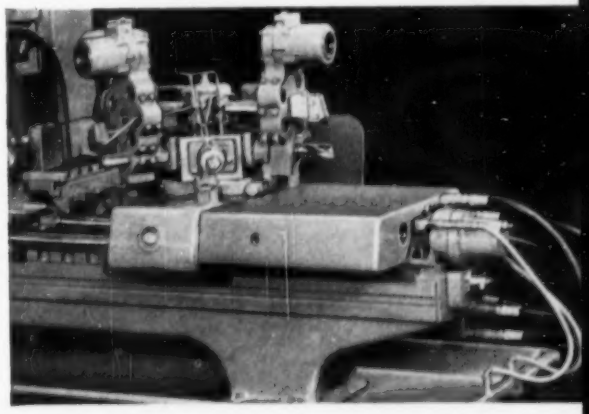
NEW GISHOLT FASTERMATIC CONTROL PANEL—simple toggle switches govern basic machine functions, cutting initial setup time in half. Master reference card is used to cut setup time still more on re-runs.



HEXAGON FEED CONTROL DRUM—positioning of adjustable flat bars on each face determines rate of feed. Thumbscrew actuator pins in slots on each face determine point of change from traverse to feed and length of feed.



GISHOLT JETracer—mounts on any one of Fastermatic's turret stations. Provides exceptional accuracy for turning, boring or facing—either straight, taper or contour. Hydraulically operated; stylus follows contour of template controlling movement of single-point tool on sliding member.



FASTERMATIC TURRET SADDLE is hydraulically powered for indexing and longitudinal movement. Automatic cycle easily set up with turret double- or triple-tooled. CROSS SLIDES—front and rear—operated by forward movement of turret saddle, can work independently, or together, with any turret face.

Spindle grinding job demonstrates how Norton Swivalign* Indicator beats "cut-and-try" method

THE JOB Finish grinding bearings and tapers on grinding wheel spindles.

THE PROBLEM Reduce grinding time and costs.

THE SOLUTION: The use of Norton's SWIVALIGN dual-electric indicator to measure swivel table adjustment in setting up the grinder.

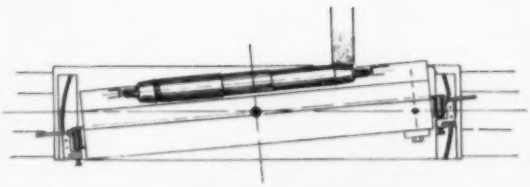
Here is another Norton forward step in the teamwork between man and machine.

The man sets the indicator . . . the SWIVALIGN device permits him to put the work in line more accurately than the human eye could see.

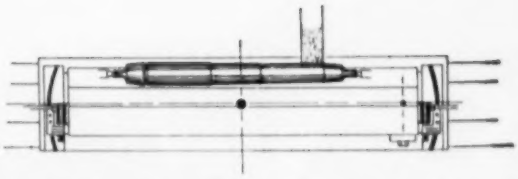
There were two savings here: First, the tedious time consuming work of the cut-and-try method was eliminated entirely; second, the grinding time for this job was reduced a full 15%. It's just another demonstration of the *every-time* cut in hours and work by use of the Norton SWIVALIGN Indicator.

FOR INFORMATION on the Norton SWIVALIGN Indicator and on its application to Norton universal and cylindrical grinders, see your Norton Representative, or write direct. And remember, only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Company, Ltd., Toronto 5.

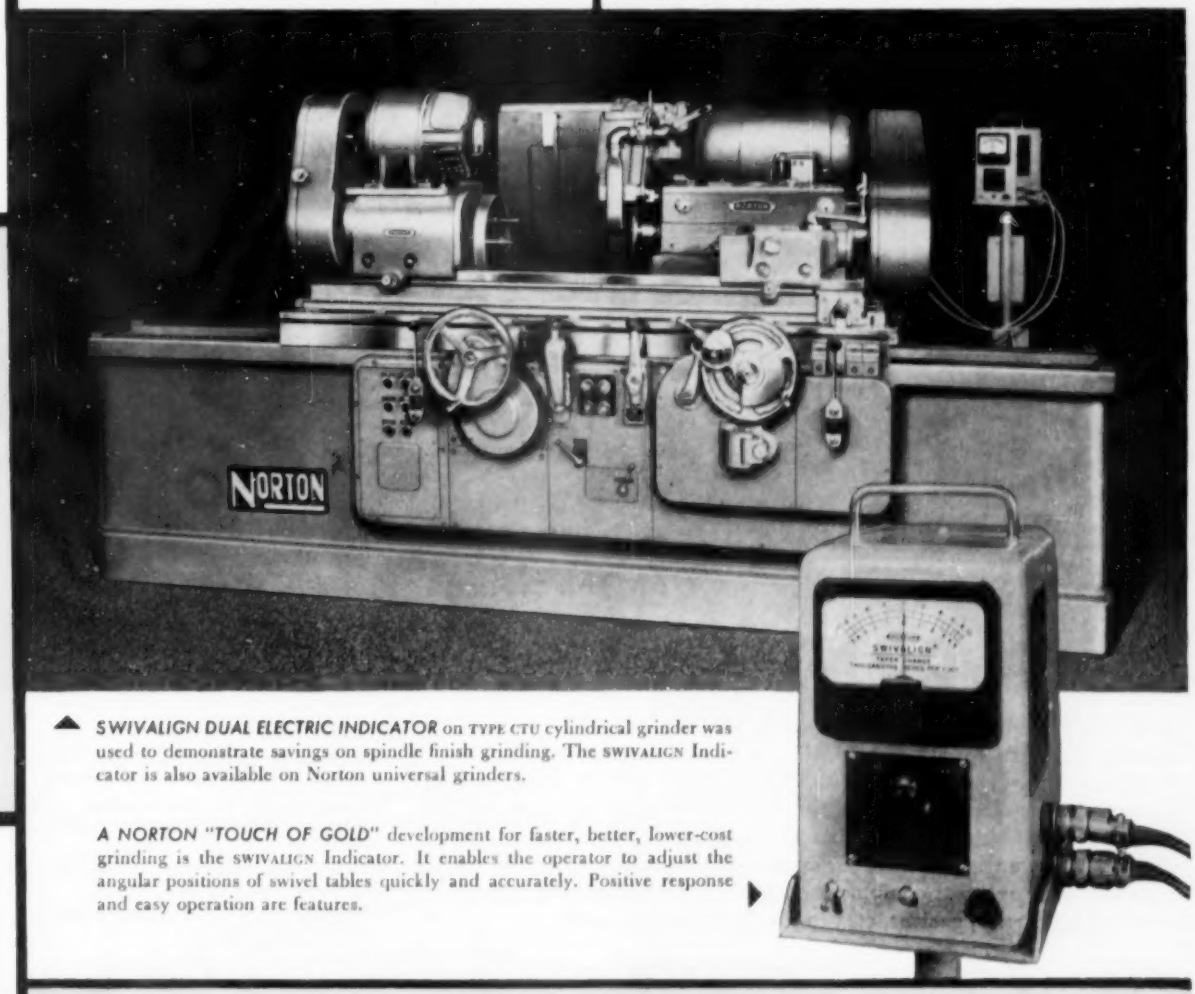
*Trade-Mark



GRINDING SPINDLE TAPER ENDS went more quickly and cost less when a Norton SWIVALIGN device was used to set the table at the correct angle to grind.



BEARING DIAMETERS of the spindle quickly moved into correct position for grinding . . . SWIVALIGN unit proved vastly superior to old "cut-and-try" method.



▲ ***SWIVALIGN DUAL ELECTRIC INDICATOR*** on TYPE CTU cylindrical grinder was used to demonstrate savings on spindle finish grinding. The SWIVALIGN Indicator is also available on Norton universal grinders.

A NORTON "TOUCH OF GOLD" development for faster, better, lower-cost grinding is the SWIVALIGN Indicator. It enables the operator to adjust the angular positions of swivel tables quickly and accurately. Positive response and easy operation are features. ▶

To Economize, Modernize with NEW

NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

District Offices: Worcester • Hartford Cleveland • Chicago • Detroit

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives Sharpening Stones • Behr-cat Tapes

TOOL CONTROL SYSTEM

Now, from Seibert, you can obtain tool control boards that are individually designed to suit your production requirements. Panels are subdivided into sections for each type of tool, and divisions are arranged as required with space for two sets of tools for each job. Tool panels and benches are available in 3, 6, 9 or 12-foot lengths. In addition, you can now obtain from Seibert pre-setting gages of all types and also optional equipment such as plastic cyclometer covers with locks, drawers, shelves, etc., to suit your specific needs.

INCREASES PRODUCTION EFFICIENCY

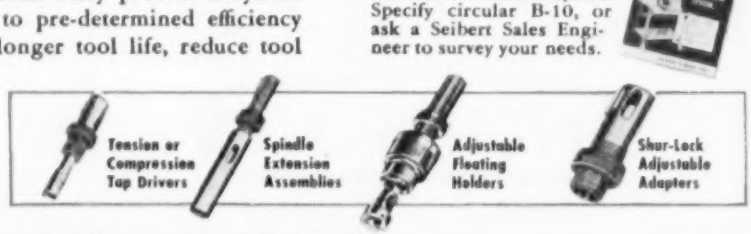
Tool Control Boards are a tested and proven method of increasing the efficiency of production machine tools. They provide a system of scheduling tool changes according to pre-determined efficiency standards. You cut down-time, insure longer tool life, reduce tool breakage, and lower scrap losses.

SUMMARY OF ADVANTAGES

- Reduces down-time, provides an efficient system of programming tool changes.
- Automatically controls machining operations; provides visual record of used life of each tool.
- Assures more efficient use of tools, reduces breakage and scrap losses.
- Provides storage and complete facilities for presetting tools at the machine.

WRITE FOR COMPLETE DATA

Get the complete story on new Seibert Control System. Specify circular B-10, or ask a Seibert Sales Engineer to survey your needs.



SEIBERT

SEIBERT & SONS, Inc. 1003 E. 24th Street • CHENOA, ILLINOIS

QUALITY MULTIPLE DRILL SPINDLE AND PRODUCTION TOOLS

TOOL NEWS

carbide

New WESSON design cuts cutter costs

"No Grind" Cutter Writes Milling History

Judging from a nationwide survey of metalworking, industry is eagerly looking for a new type of milling cutter, embodying the features to be found in Wesson's newest "no grind" series. Among these features are:

1. **No Cutter Grinding**—Use of low cost throw-away inserts eliminates blade or cutter grinding.
2. **Lower Blade Cost**—Ability to use throw-away inserts with 'commercial ground' thickness tolerances. Precision grinding of faces not necessary.
3. **Quicker Blade Index and Change**—Locking mechanism has only 2 parts—a wedge which forms the chip gullet and a screw which locks and unlocks blade with a half turn.
4. **Automatic Accurate Blade Locating**—Just drop the blade in a clean slot. It locates itself.
5. **Less Down-Time for Tool Changes**—Automatic blade locating when indexing and quick lock-unlock features reduces tool change time to the minimum.

(continued on page 2)

THROW-AWAYS... HOW FAST ARE THEY COMING?

Throw-away tooling is bidding fair to take over a lion's share of metal cutting—both single and multiple point.

Would you like a copy of the first detailed report on the Wesson-sponsored nationwide study on the future of 'throw-aways'? Drop a line on your company letterhead to "Market Research Director", Wesson Company, 1220 Woodward Heights Boulevard, Ferndale 20, Michigan, and he'll be glad to see that you get a copy.

TOOL NEWS carbide

COST CUTTING IDEAS FROM OTHER SHOPS

Have you tried these?

(Continued from a previous issue of Carbide Tool News)

Interchangeability Charts—Something that tells you quickly on what operations you can use identical or similar size tools. Helps to re-assign tools to other jobs on other parts, cuts inventories, insures maximum tool use. One large company is saving $15,000 to $20,000 per month with such charts.

• • •

Progressive Costs—One company reports big reduction in scrap and much better cost-consciousness of workers by telling them how much is invested in a part by the time it reaches them. The part is mounted on a board at each key operation. Alongside is lettered the cost of that part *up to that point.*

• • •

Fault Finding Committees—Putting criticism to work can pay off. Committees can be composed of process, methods and tool engineers who have to meet every so often and come up with criticisms and suggestions of things that probably could be done better some other way. They don't have to agree on what is the best way. The idea is to agree that what you are doing is not the best. Frequently come up with real cost cutting ideas.

• • •

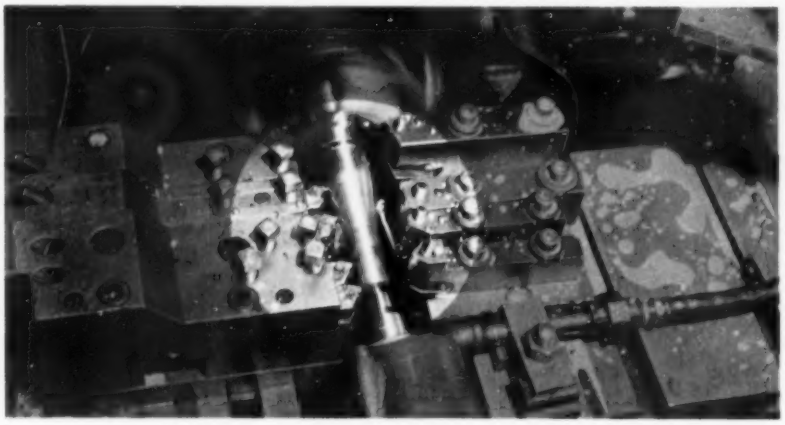
Program Tooling—When tooling up on any operation for the first time, don't just buy tools; buy the brains of a tool company service engineer with the tools. Sure it costs a little bit more for that first set of tools—but it pays for itself on the job over and over again. Wesson engineers prove that every day.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

Cost Cut Twice on Same Job by Wesson In-Plant Engineering

	Original	Step No. 1	Step No. 2
Tool Style	Milled & Brazed	Multicut & Inserts	Multicut & Inserts
Tool Material	HSS & Carbide	Wessonmetal WM & (1) HSS	Wessonmetal WM
RPM	309	309	411
Feed rate, front	.007	.007	.0118
Feed rate, rear	.0036	.0036	.008
Tool cost per 100 pcs.	$7.35	$3.35	$1.75



The manner in which Wesson's in-plant engineering can help reduce tool cost not just once but over and over is illustrated in the table. The job was the turning of forged steering knuckles at a truck plant.

Originally tooling was a combination of high speed and milled-and-brazed single point carbide tools. There was fairly high tool breakage. First switch was to slug-type solid Wessonmetal inserts in Multicut holders with no basic changes.

Overall tool cost however had been more than cut in half. Every tool on the job with one exception showed better life. That one, used for cutting a thread relief previously had had the best life but now, while producing more pieces per grind than formerly, actually was the worst of the lot.

Tool material change didn't help, so the second step was to change the part design to eliminate this tool. A grade change did help however on another tool in the setup used for chamfering the end of the knuckle.

With tool grades set, adjustments in feeds and speeds resulted in further improvement in overall tool life.

Are you using Wesson's in-plant engineering method of cost reduction? Other metal working plants are. They have learned that Wesson's cost-cutting service doesn't stop with the tool order. That's when it really gets going.

"No Grind" Cutter Writes Milling History—*(continued from page 1)*

6. **Smooth Chip Flow**—Shaping of chip gullet gets chips out of the way quickly and smoothly—makes for free cutting.
7. **Minimum Body Wear**—Specially hardened and quick replaceable chip gullets insure long-life cutter body with the very minimum of upkeep.
8. **Rigidity**—The cutters are tops in supporting the carbide blades. Almost the entire back face is supported by husky steel while the wedge bears on half the entire front face.

Here is what truly appears to be tomorrow's general purpose milling cutter. With all cutter grinding eliminated—with eight indexes per blade before you discard it—you can even cut your cutter body inventory.

Litho in U.S.A.

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Maker of Parts for TV Sets Gets Good Results with BTR

Here's a job where BTR (Bethlehem Tool Room) tool steel gets a good chance to show what it can do. The multiple-purpose die is used by Suckle Electronics Company, Camden, N. J., to pierce, notch, louver and form high-voltage shields for TV sets. The shields are made of 16-gage steel, and are turned out in a 95-ton press at the rate of more than 400 pieces per hour.

Engineers at Suckle Electronics report that they are well satisfied with BTR. They particularly like its safe-hardening property, toughness, and ability to wear and wear.

BTR is our general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel. It's a grade that is consistently racking up substantial shop savings for manufacturers in a wide range of applications. Your Bethlehem tool-steel distributor will be more than pleased to furnish complete information about BTR. Why not give him a phone call right now, while you have it in mind!

• • • • • • • • • • •

CR-MO-W Gets the Okay

After being machined by the end mill, this hot-piereing punch, made of Bethlehem Cr-Mo-W (chrome-moly-tungsten) tool steel, gets final size check by micrometer. Cr-Mo-W, an excellent hot-work steel, contains 5 pct chromium. Because of its characteristics, it is perfectly at home on jobs that involve shock, drastic changes of temperature, and heat-checking.

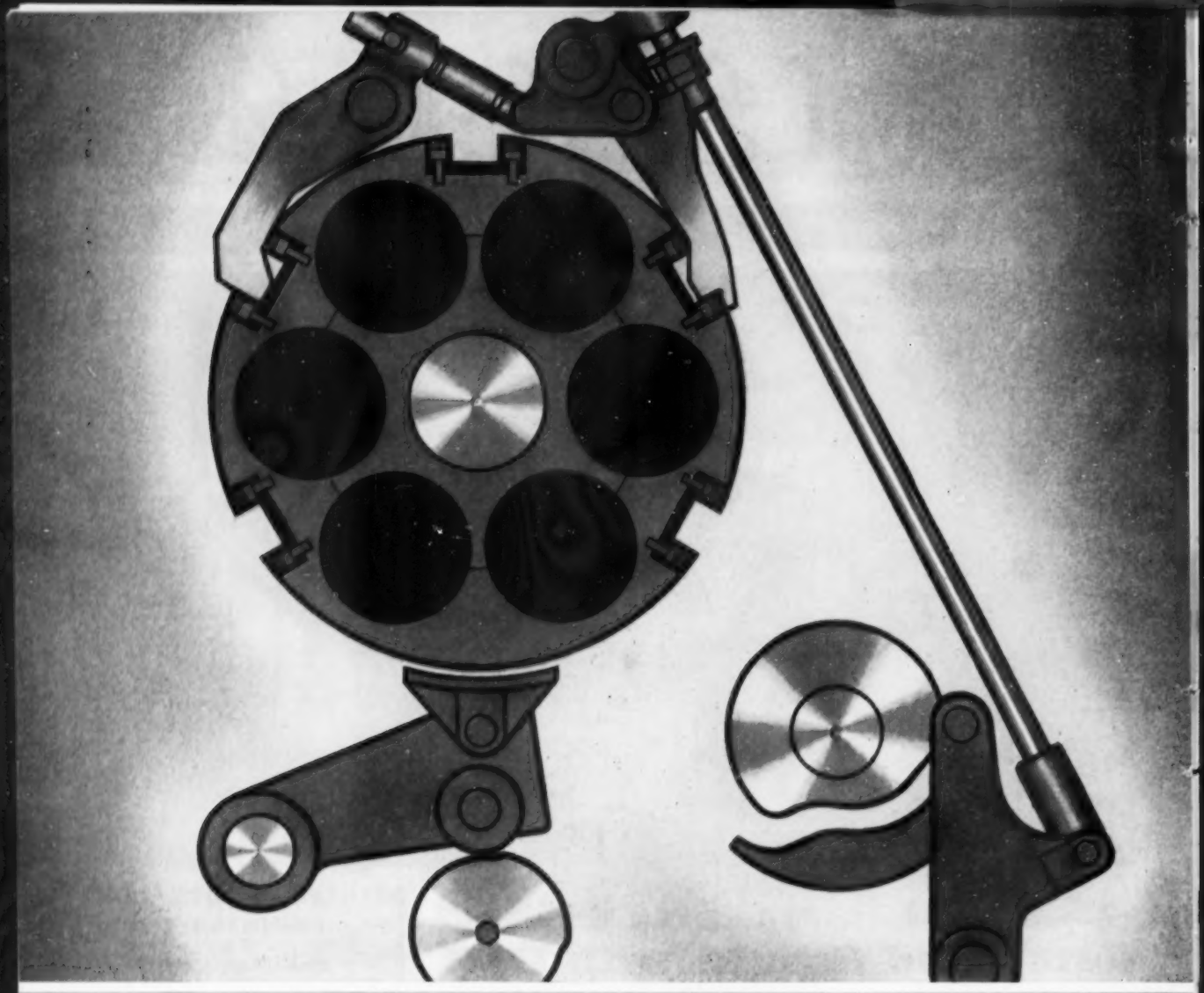
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Don't Double Everything!

Attempting to double everything may be a wise policy in the investment field. But it can cause trouble when applied to the selection of tool steels. For example, when a successful production line is to be duplicated in larger size, the same grade of steel should not be used for each part without further consideration.

The main difficulty which arises is that the steel for a given part may not have sufficient hardenability when the part is to be made in a larger size. The reason is that tools which have been only partially hardened through will not be as strong as the deeper hardened or through-hardened tools of the original model. Secondly, the use of low-hardenability steels may be troublesome because the larger tools may be under-tempered in attempting to develop the desired degree of surface hardness. You may find that tools which are improperly tempered sometimes crack in treatment, grinding, or in service. Steel for each tool must therefore be selected with reference to the size in which the tool is to be produced.

Litho in U.S.A.



heavier, faster cuts

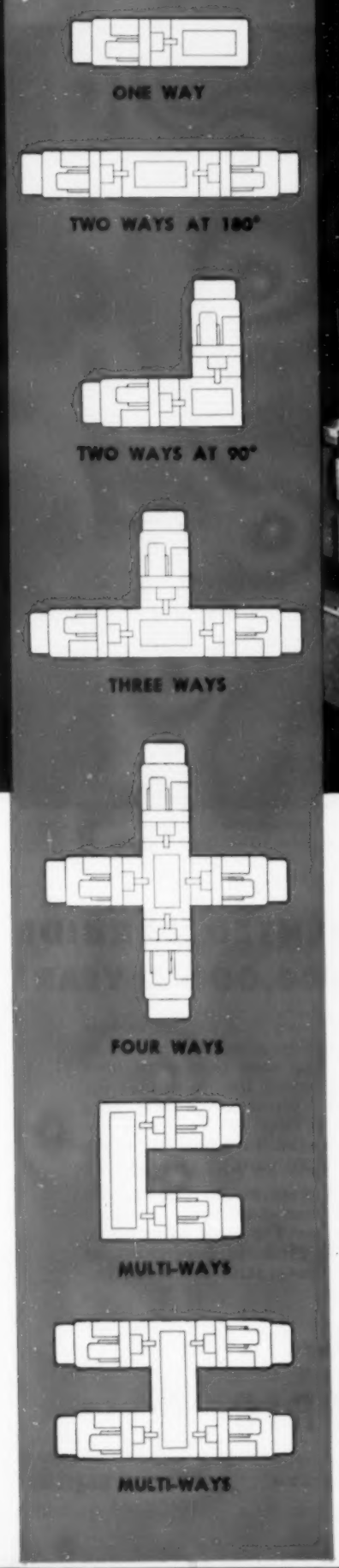
with accuracy

This cross section of a New Britain spindle carrier illustrates three features that assure permanent accuracy under today's constant heavy duty use.

1. Positive, accurate location of the carrier means perfect spindle alignment with the tool.
2. Rigid clamping of the carrier makes it integral with the frame during the cutting cycle, eliminating carrier weave and vibration.
3. Automatic spindle carrier lifting mechanism eliminates all wear during indexing, and so guarantees preservation of initial accuracy.

Features like these don't show on the surface — you "see" them in the form of continued accurate production, year after year. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Automatic Bar Machine
NB



Ex-Cell-O 4-Way Machine precision bores four holes simultaneously, holding 90° angles.

7 ways to increase your production

Three new features on all Ex-Cell-O Way Machines give even greater production and precision

The diagrams at left tell a story.

Ex-Cell-O Way Machines using standard components in the combinations illustrated perform precision boring, turning, facing, grooving and chamfering operations economically and quickly. They take large work pieces in stride—the spindles move to the work.

In each machine three new features assure long life, dependable operation, and exceptional accuracy.

The features: (1) ways are hardened and ground, (2) slides are fully supported the length of the stroke, (3) hydraulic control panels give a wide range of automatic cycles.

Write Ex-Cell-O in Detroit for further information. Better still, call in an Ex-Cell-O representative.

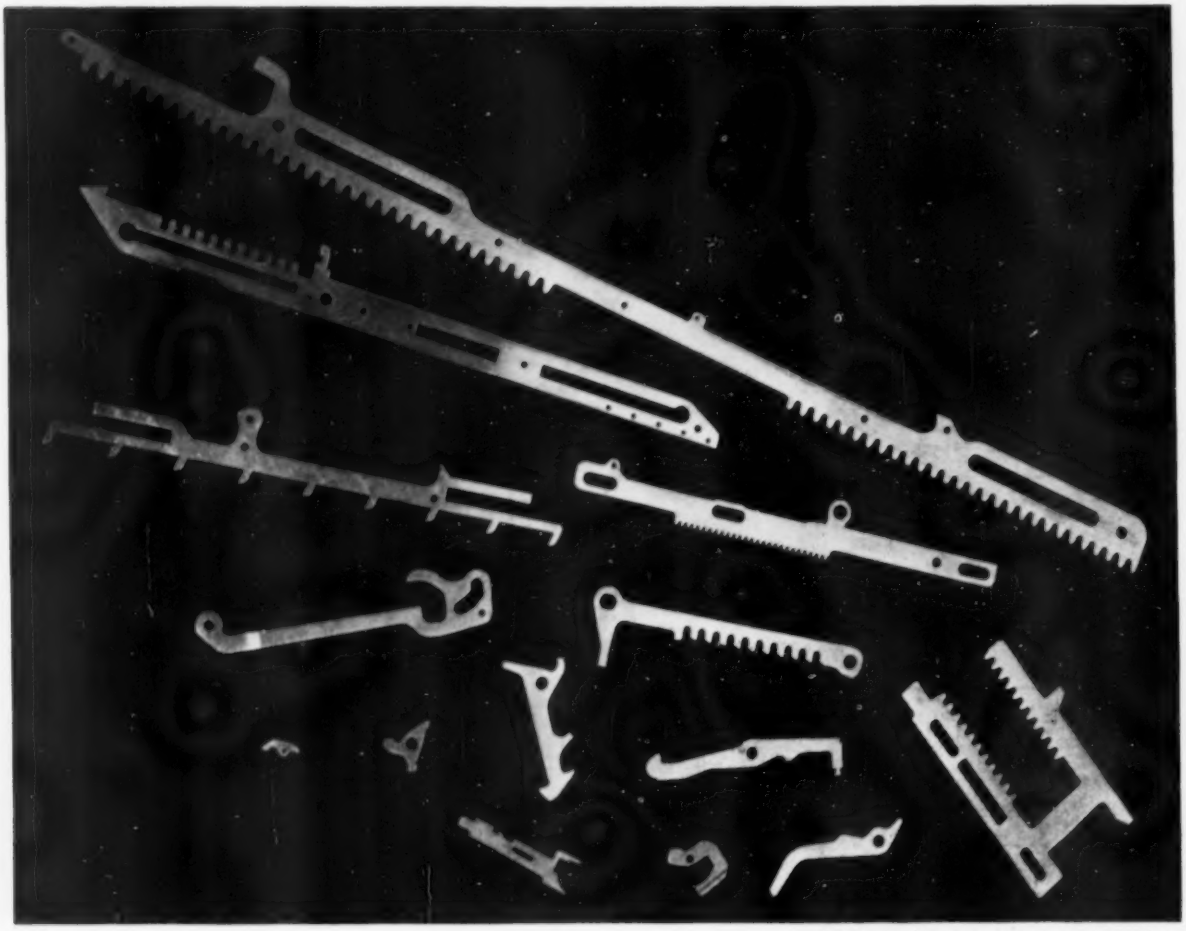
EX-CELL-O CORPORATION

EX-CELL-O FOR PRECISION

XLO

DETROIT 32, MICHIGAN • Manufacturers of Precision Machine Tools • Grinding Spindles • Cutting Tools • Railroad Pins and Bushings • Drill Jig Bushings • Aircraft and Miscellaneous Production Parts • Dairy Equipment

56-44



Business-machine parts stamped with dies made by Eglinton Carbide Products, Inc., Lincoln Park, Mich.

Stamp pre-tempered steel .020 to .040 in. thick . . .

DIES MADE WITH CARBOLOY® CEMENTED CARBIDE SAVE BURROUGHS CORPORATION $300,000 A YEAR!

Dies equipped with Carboloy® cemented carbide now enable Burroughs Corp. to stamp business-machine parts from pre-tempered steel 2-4 times thicker than previously possible.

Parts made from pre-tempered (instead of annealed) stock come out of the dies finished . . . and made to required hardness. This permits Burroughs to eliminate many secondary operations. On one of the parts shown above, for example, heat treating, shaving, straightening, and five other operations are eliminated. Yearly saving on this part alone amounts to over $300,000 . . . and more than 10,000 hours of production time.

These savings far more than pay for carbide dies. In addition, carbides bring new savings in downtime and grinding costs because of their phenomenally long service life. A carbide die has stamped 1,000,000 pre-tempered steel parts per grind . . . while steel dies producing the same part from *annealed* stock had to be re-ground after only 10,000 parts.

Our engineers will work with you or your die maker on the application of Carboloy Cemented Carbides to your dies. For more information, write: *Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Ave., Detroit 32, Michigan.*

Progress Is Our Most Important Product

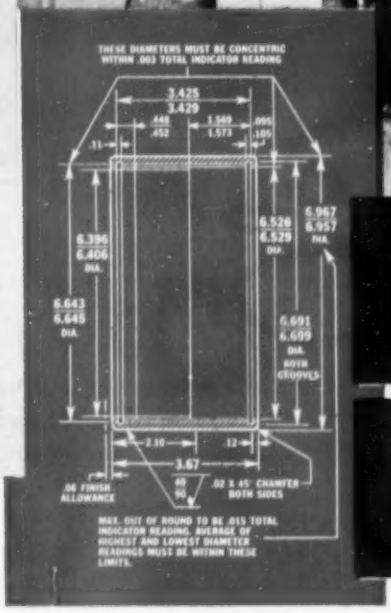
GENERAL ELECTRIC

Automobile Manufacturer produces

Repetitive Pieces to Close Tolerances with

BULLARD MULT-AU-MATIC Type "L"

At one of the nation's largest automotive plants, a number of Bullard Mult-Au-Matics, Type "L" are employed to produce automatic transmission parts. According to the Process Engineer "The transmission is the most precision piece of equipment in the entire car — with many moving parts fabricated to close tolerances."



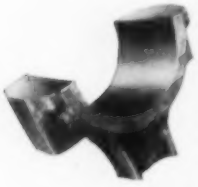
If you have need to manufacture to exacting tolerances it will pay you to investigate the many advantages offered by Bullard Mult-Au-Matic, Type "L".

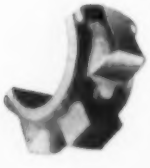
Send for catalog today

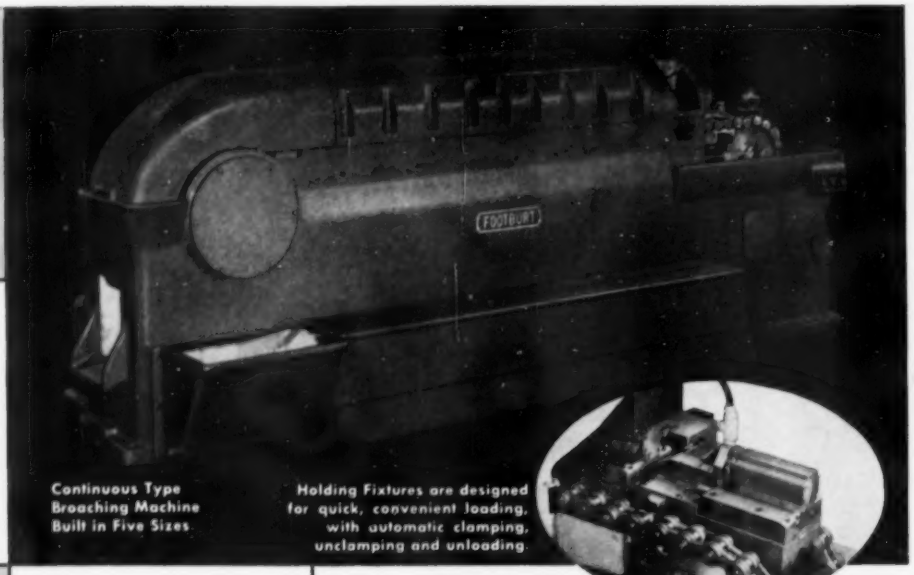
THE
BULLARD
COMPANY
BRIDGEPORT 9, CONNECTICUT

THE BULLARD COMPANY
286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT
Please send me a copy of the
NEW MULT-AU-MATIC, TYPE "L" CATALOG

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

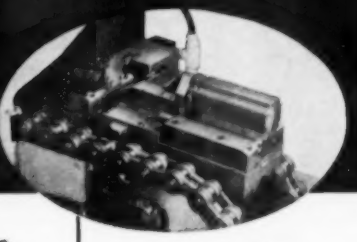


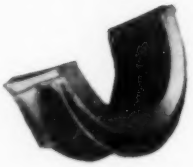




Continuous Type Broaching Machine Built in Five Sizes

Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.





machining connecting rods and caps an opportunity for

Surface Broaching

■ Surface Broaching is a modern machining method that in many cases shows reduced costs through higher production, finish to closer tolerance, and low tool maintenance costs. If you machine large quantities of duplicate parts we will be glad to work with you on the possibility of adopting Footburt Surface Broaching Machines. Send us blueprints and hourly production requirements for our recommendations.

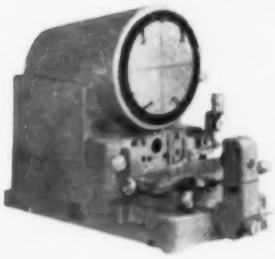
THE FOOTE-BURT COMPANY

Cleveland 8, Ohio • Detroit Office: General Motors Building

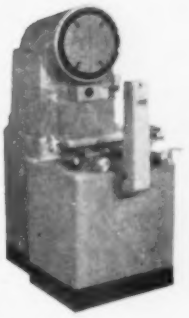
FOOTBURT

PIONEERS IN SURFACE BROACHING

Speed production with projection gaging . . . and the *right* KODAK CONTOUR PROJECTOR



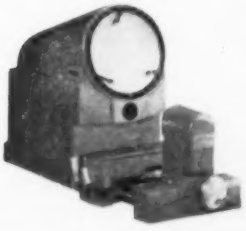
Model 14-2A—Do you need a versatile precision measuring instrument for toolroom or production lines? Kodak Model 14-2A measures intricate parts to the order of .0001", lets you do routine gaging by comparing the part with a chart. Measuring attachment is equipped with micrometer guaranteed accurate to .00005" over the entire 1" range. Dial indicator ends need for micrometer feel. Kodak Measuring Blocks, in standard dimensions, can be inserted in the horizontal and vertical micrometers to cover full travel range. Has 14-inch screen. *You can use any Kodak Contour Projector anywhere in normal light.*



Model 14-5—Are the parts you have to inspect heavy? Model 14-5, optically the same as Model 14-2A, comes with an extra-large, heavy-duty worktable; its box-like construction withstands great weight without measurable deviation. Model 14-5 has the same measuring range as the Model 30, with 8 inches of table travel in both horizontal and vertical planes. *Optical inspection requires little training, and Kodak Contour Projectors are designed with the operator's convenience in mind.*

Model 30—A heavy-duty worktable plus a 30-inch screen makes this the model for toolroom or production inspection of large parts. Table traverse is 8" in both horizontal and vertical planes, focusing travel totals 3". Engraved dial, calibrated to 2' of arc, permits angular measurement reading directly, without need of vernier. *The versatility of optical inspection and the adaptability of Kodak Contour Projectors let you do many measurement tasks with one unit.*

Model 3—Check long runs quickly and accurately with this low-cost instrument. Designed for use with your own staging fixtures, Model 3 comes with flat stationary table. Adjustable chart holder permits "set lines" on ground-glass overlay chart to be brought to coincidence with "set surfaces" of the fixture, avoiding need for table movement. *Seemingly impossible-to-measure shoulders, holes, angles, and relationships are easily gaged on Kodak Contour Projectors.*



Model 8—Inspect horizontally and vertically, anywhere in your plant with Model 8. Take this cast-aluminum unit wherever there's need for fast, accurate inspection of small parts. For horizontal inspection, simply stage the part in a simple holding fixture. For vertical measuring, turn Model 8 on end and stage the part on a flat glass stage. Part image on the 8-inch screen is erect and unreversed both ways. Six magnifications from 10× to 100×. *Kodak Contour Projectors have rugged housings to more than withstand conditions of normal use.*

Eliminate receiving inspection bottlenecks, avoid waste on reject parts, predict tool failure before it occurs, speed inspection to match production, make final measurements. Which of these Kodak Contour Projectors will solve your production problem?

How to learn more about Kodak Contour Projectors

From the Kodak Ektar Lens system, (heart of Kodak Contour Projectors), to the precision machining of critical parts, these units are built to meet your most rigid requirements.

To the basic Projector, you can add a number of optional staging and measuring attachments. Your Kodak Representative will be glad to describe these to you and explain their uses.

For the name of our representative or for a descriptive catalog on Kodak Contour Projectors, write to Special Products Sales Division, Eastman Kodak Company, Rochester 4, N. Y.

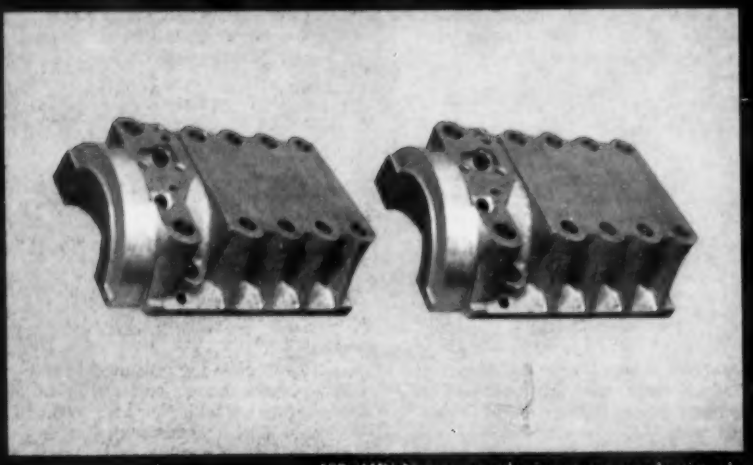
EASTMAN KODAK COMPANY
Rochester 4, N. Y.

the
KODAK CONTOUR PROJECTOR

Kodak
TRADEMARK

THREE NEW DEVELOPMENTS
Increase Production

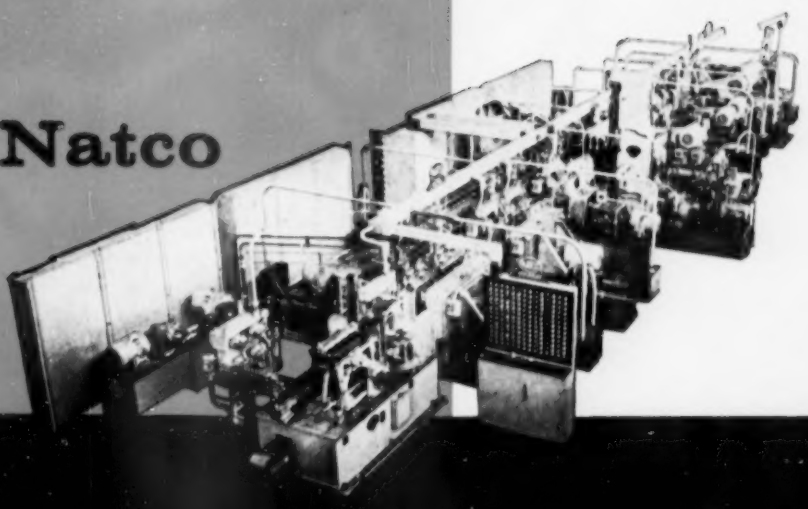
2-at-a-time processing



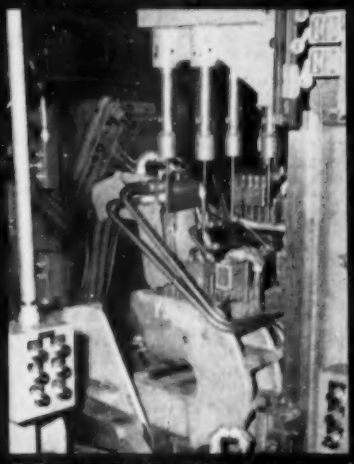
300 HP Natco greatly increases production by processing two complete sets of bearing caps at once.

Bearing caps—240 *sets* per hour—six times the production rate of the machine replaced! This new Natco processes two complete sets at once. It loads surface-broached castings automatically, performs 80 machining operations, places matched sets of finished bearing caps on the assembly conveyor. In addition to broaching and sawing, this 300 HP, 27-station Natco, drills, reams taps, turns, mills, probes and faces.

help this Natco 600%

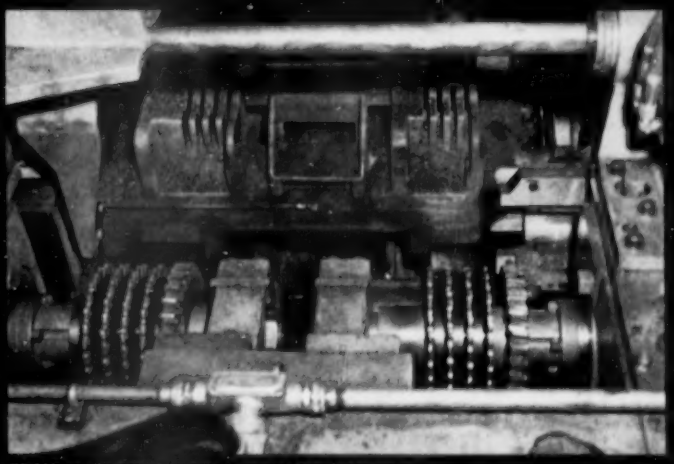


Unique Broaching Station



Fully automatic broaching station eliminates need for withdrawing broaching tools after cut. Broaching tools are pulled completely through hole, removing .030" stock.

New Rigid Saw Station



80 HP sawing station cuts two castings into complete sets of 5 caps each. All surfaces parallel within .0015". Fixture feeds castings into stationary mounted saws, providing rigidity for accurate 14 ipm cutting.

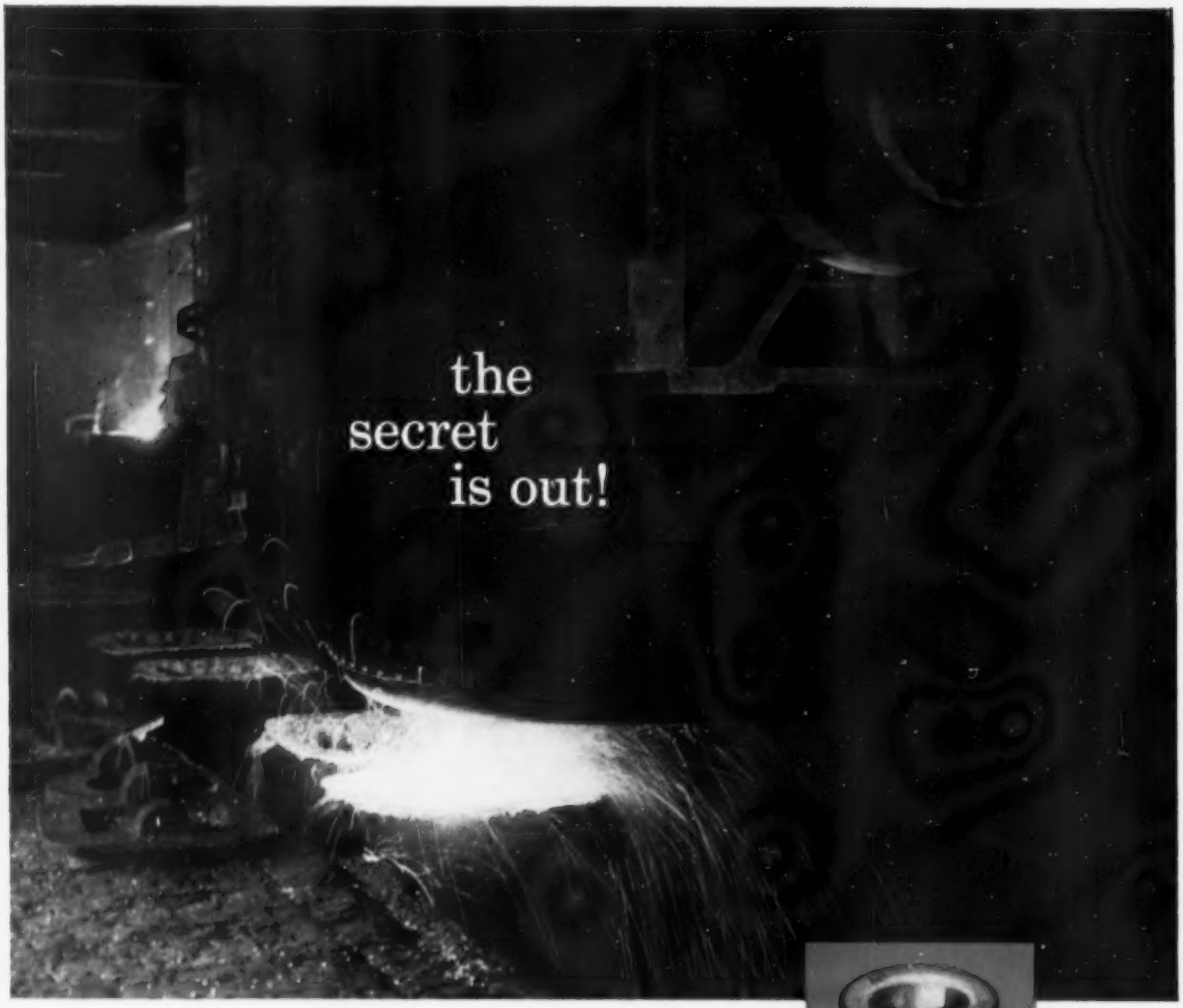
Whatever your high production problem, our engineers will work closely with your people to develop exactly the method and the machine to do your job best. Besides special way-type, index and transfer machines, Natco also builds multiple drilling, boring, facing and tapping machines. Call your nearest Natco office in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles. Distributors in other cities.

Partners in Production

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC. *Richmond, Ind.*

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan



It's the *steel* in ACE drill bushings!

TWO YEAR SECRET *STEEL* FORMULA ASSURES LONGER DRILL BUSHING LIFE...

If you are one of the many ACE drill bushing users who have told us about the *extra-long bushing life* you have been getting from our drill bushings—*we thank you*...and *now* we are going to tell you why!

More than *two years ago* ACE, without telling anyone and without raising costs, began making shipments of drill bushings made of a special high-carbon chromium bearing steel! With this new oil-hardening steel coupled with an exceptionally high degree of precision in the heat treating process, ACE engineers found that bushing life was increased tremendously. Rather than make an announcement at that time... we hoped that user comments would prove the importance of the new steel—and they certainly have! From all parts of the nation ACE drill bushing users have told us about the much longer life they have been getting... how production costs from both a material and labor standpoint have dropped sharply. Now...the secret is out...it's the steel!

Look to ACE for Quality...Accuracy... Largest Deliverable Stocks Anywhere!

Write today for the all new catalog containing technical data, comparison tables, price lists and name of dealer in your area.

ACE DRILL BUSHING CO., INC.
5407 Fountain Ave., Los Angeles 29, Calif.

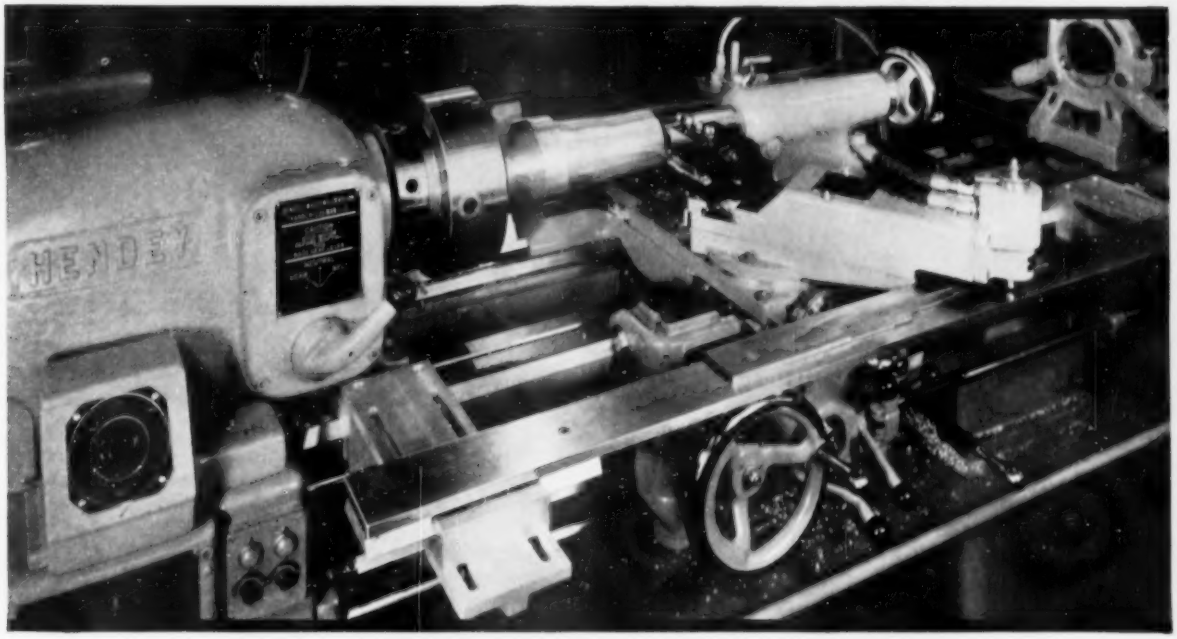
(Pay-As-You-Depreciate) Finance Plan

You get

top value per dollar

with a Hendey No. 2E lathe

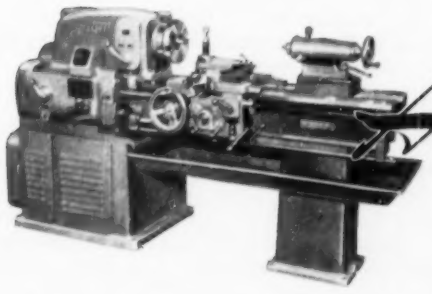
QUICK-CHANGE tracer attachment
CUTS CONTOUR TURNING COSTS!



The precision performance and fast, easy setup of the new hydraulic tracer control introduce previously unheard-of economy wherever three or more pieces are to be step-turned. Available as optional equipment, the new tracer is a packaged unit which simply replaces the standard compound . . . no drilling required. Mounts on front of lathe where the flat template stays clear of chips and coolant.

The Hendey No. 2E is widely known as the multi-feature lathe offering top value at moderate cost. Electronic drive with fingertip stepless speed control gives unmatched ease of precision production and makes the Hendey No. 2E ideal for hydraulic tracer control. Contact your Hendey dealer for details and specifications.

for precision with production, buy Hendey

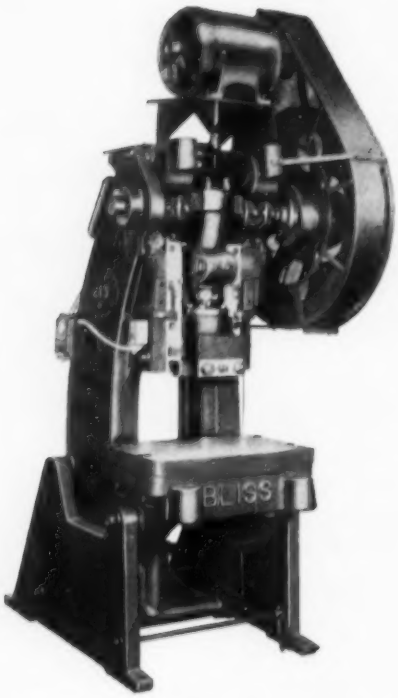


Hendey machine division
BARBER-COLMAN COMPANY
32 Loomis St., Rockford, Illinois

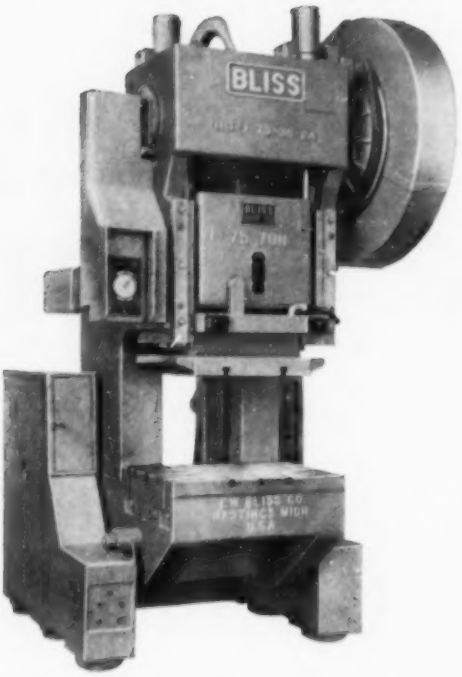
BARBER COLMAN ®

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-2-51

Bliss inclinables offer you a wider



Standard Inclinable Presses—as furnished in the 10 to 125 ton range. No. 21-S press, 45 ton capacity, shown here.



Enclosed Inclinable Presses—75 to 200 tons. A 75-ton capacity model is shown here.

More standard types Bliss builds *23* standard inclinables—open-back inclinables, JIC inclinables, hydraulic inclinables, double-crank inclinables . . . offers a wider range of capacities and bed areas than any other make.

More standard clutches The Bliss Positive rolling key clutch and a choice of Bliss crankshaft or driveshaft mounted air friction clutches have been proved on thousands of presses. Bliss has the type of clutch best suited to your work.

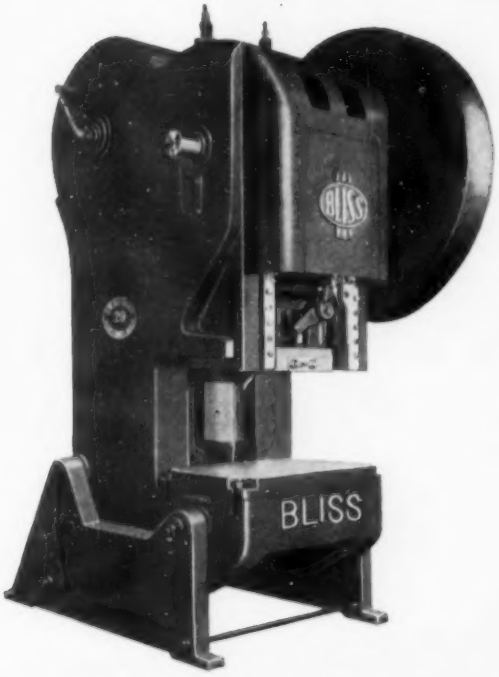
More standard feeds Bliss designs and manufactures its *own* line of roll and dial feeds. This single responsibility for both presses and feeds is the press user's assurance that feeds are easily installed and easily adjusted.

More standard cushions Five different types of cushions, in a range of sizes that meet every need, make any Bliss inclinable a double-action press. Cushions are especially designed for the press, and the presses designed to receive them—either assembled to press before shipment or easily installed years later.

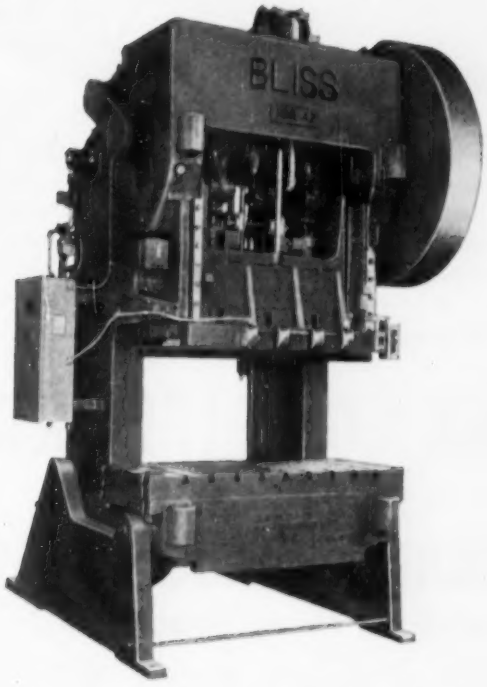
. . . And a million dollar parts and service program to protect your investment!

Because Bliss *mass-produces* its inclinables, maintaining a stock-pile of spare parts is a simple matter. The million-dollar inventory of spare parts of Bliss' inclinable plant is by far the largest in the industry and includes clutch plates and parts, shafts, gears, pinions and the like. Moreover, Bliss maintains a separate, specially-trained organization whose sole purpose is to service your spare parts needs as quickly as possible.

choice of standard types and sizes



Standard Enclosed Inclinable as furnished in 150 and 200 ton sizes. No. 29, 150-ton capacity, is shown above.



Double-crank Inclinable Presses—from 18 to 175 tons. No. 108, of 100 tons capacity, is shown here.

A few of the reasons why BLISS inclinables outsell all other makes ... *and always have*

- Cast Meehanite frame—stronger, tougher. Fine grain structure dampens noise and vibration.
- Clutches—whose design has been proved by the thousands now in use.

  Gibs are close fitting, extra long, and insure accurate slide alignment at all points in the stroke. Simple to adjust so that original accuracy can always be maintained.

  Choice of hand, semi-automatic or automatic lubrication.

NEW catalogs now available

32 pages—describes frames, feeds, clutches, cushions and complete line of open back and enclosed single-crank inclinable presses. Gives dimensions and specifications. Catalog No. 2-D.

12 pages—describes these versatile extra-width double-crank presses. Gives dimensions and specifications for entire line. Catalog No. 3.

BLISS
SINCE 1857

BLISS is more than a name ... it's a guarantee!

E. W. BLISS COMPANY, Canton, Ohio

Presses, Rolling Mills, Special Machinery

U. S. Plants in Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pa. *Branch offices in* Burbank, Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Pittsburgh, Philadelphia, Rochester, Salem, San Jose, Toledo, Washington, D. C.; and Toronto, Canada; E. W. Bliss (England) Ltd., Derby; E. W. Bliss Co. (Paris), France. *Other representatives throughout the world.*

SHOW THIS TO YOUR TOOLMAKER

Ask him if he doesn't agree that the Leland-Gifford No. 2LMS Toolroom Drill Press provides every feature and convenience needed in the modern toolroom for fast, accurate, effortless drilling and tapping. Developed in cooperation with leading tool engineers, this machine has won wide acceptance as the ideal drill press for general purpose toolroom use. Write for complete information.

LELAND-GIFFORD
No. 2LMS
TOOLROOM DRILL PRESS
with all these features:

1. Illuminated indicating shift with cutting speed chart.
2. Conveniently located hand wheel for changing spindle speeds and shifting back gears without stopping machine.
3. Positive stop for accurate depth adjustment.
4. Capacity of No. 2 Morse taper. No. 3 MT optional.
5. Extra large 37″ x 25″ or standard 26″ x 25″ work table.
6. 26″ swing with 13″ overhang.
7. Handy push-back table raising crank and quick-acting table lock.
8. Foot switch start-stop motor control leaves operator's hand free.
9. Counterbalanced sliding head for effortless vertical adjustment.
10. Built-in light for table and work surface illumination.
11. Reversing motor control for tapping — provides manual control from feed lever or automatic control by depth stop.
12. Sensitive hand lever feed with ratchet adjustment.

LELAND-GIFFORD
Drilling Machines

WORCESTER 1, MASSACHUSETTS, U. S. A.

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INDIANAPOLIS 6, P. O. Box 1051
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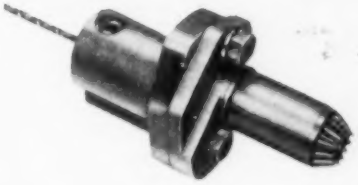
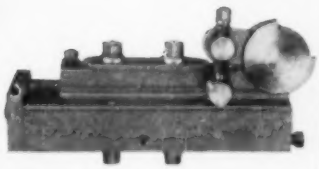
Announcing

New Additions to the RIGHT R and L LEFT Family! . . .



NEW ON AND OFF CENTER DRILLING ATTACHMENTS

This ingenious turret drilling attachment is designed to save you second set-up time. It is no longer necessary to remove the cut-off piece in order to drill an off-center hole in the end of a bar. Merely stop the spindle, bring this tool into the work and continue the operation. The tool will operate within the capacity of the machine. (Available in ⅝", ¾" and 1" diameter shanks.)



NEW TOOL HOLDERS FOR MULTI-SPINDLE AUTOMATICS

This tool holder, made for circular tools, can be used on the front or rear cross-slide of multi-spindle automatics . . . It is made to operate within the capacity of the machine.

NEW TOOL-SLIDE KNURLING TOOL FOR MULTI-SPINDLE AUTOMATICS

This tool can be used in the tool-slide of multi-spindle automatic screw machines or in the turret of turret lathes. The knurls may be adjusted for various diameters by turning them on an eccentric shaft . . . The tool will operate on any diameter within the capacity of the machine. (Another new R and L TOOL is the Cross-Slide Knurling Tool for Multi-Spindle Automatics.)

Write for complete catalog of R and L TOOLS and literature and prices on these new tools.

RIGHT R and L LEFT TOOLS

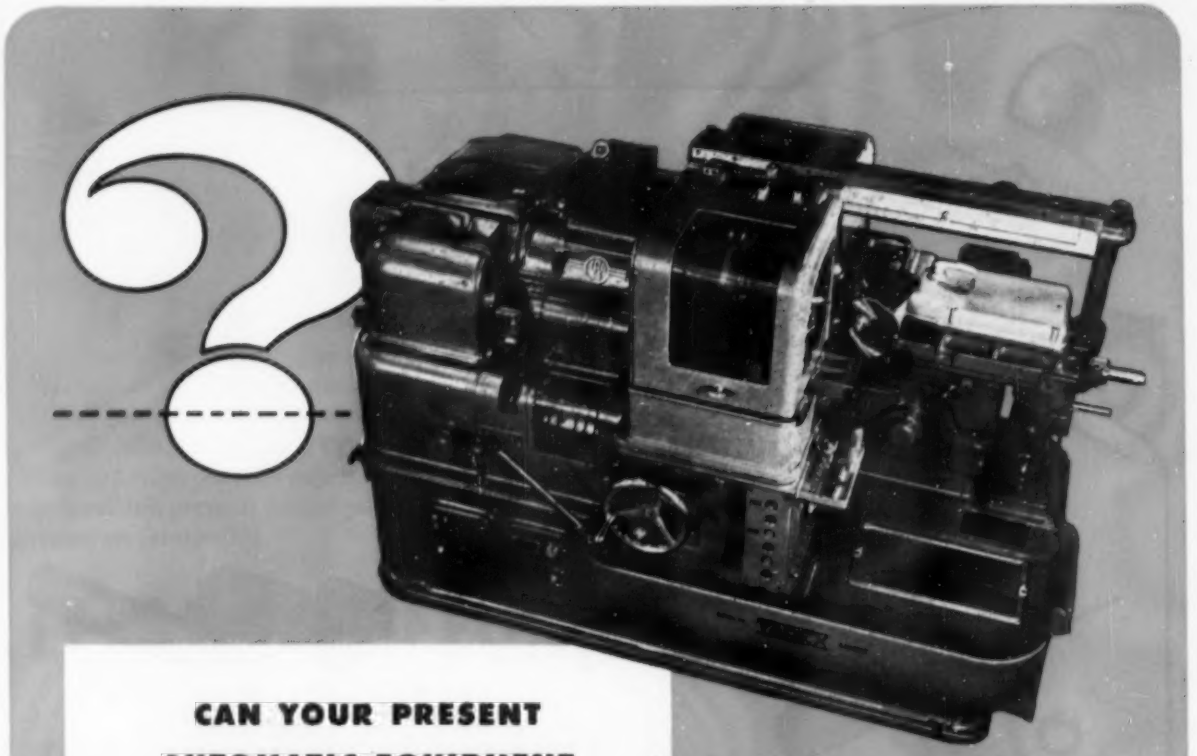
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

OTHER FAMOUS R and L TOOLS:
TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

R and L TOOLS
1825 BRISTOL ST.
PHILADELPHIA 40, PA.

☐ Please send me your new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

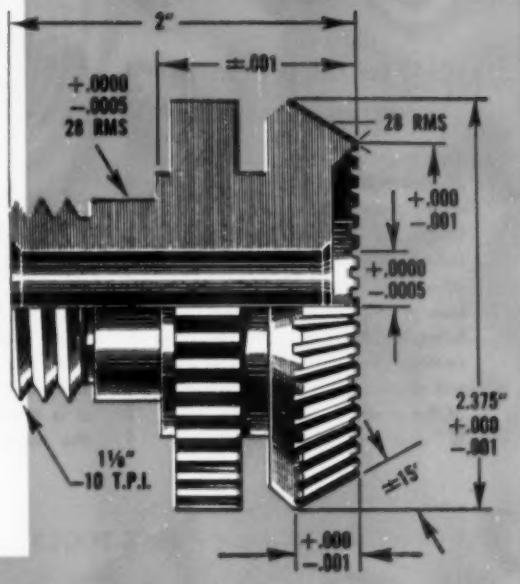
NAME .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....



CAN YOUR PRESENT AUTOMATIC EQUIPMENT *make this* BEVEL CLUSTER GEAR *complete* FROM BAR STOCK *in one operation* READY FOR GEAR CUTTING?

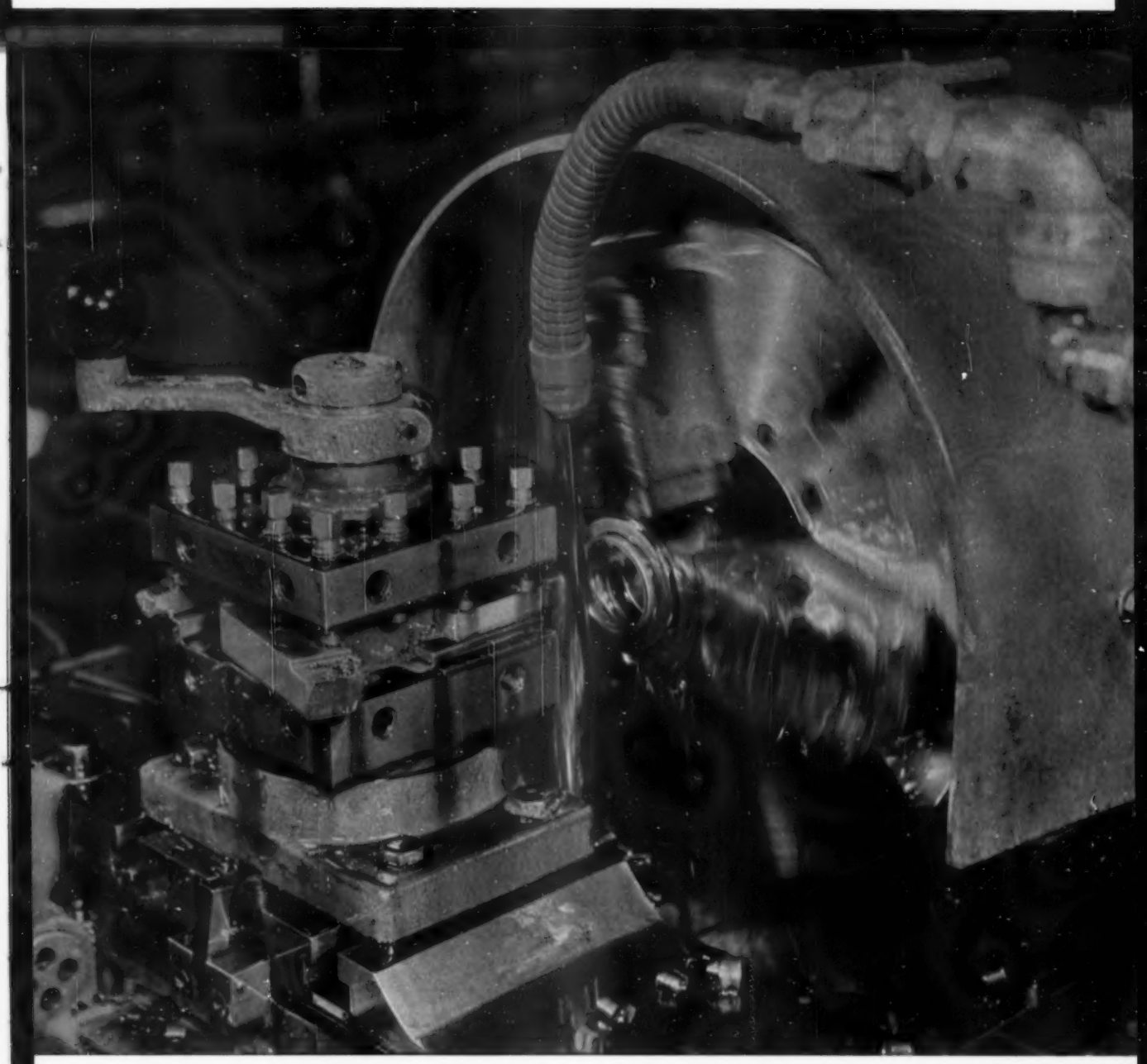
...it can be done on the

TAREX



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.



NOW...

a complete line of cutting oils

under one great name...

GULFCUT

GULF

GULFCUT

cutting oils increase tool life . . . lower machining costs!

- 9 different oils—a modern cutting fluid for every specific job
- Each Gulfcut oil scientifically compounded to meet exact needs

As an aid to simplification, all the famous Gulf cutting oils are now available as one complete line, under one name: GULFCUT. By ordering "Gulfcut" you can select from 9 different shop-tested cutting oils—and there's a proper type for every metal cutting need. The Gulfcut line includes mineral-lard oil, sulfurized-mineral oils, sulfurized-mineral-lard oils, sulfo-chlorinated-lard oils, and emulsifying oils. Your Gulf Sales Engineer will gladly show how Gulfcut cutting oils can mean longer tool life and reduced machining costs in your shop!

GULFCUT 11A AND 11D
Non-staining, non-corrosive mineral-lard oils, generally recommended for machining non-ferrous metals.

GULFCUT 21A, 21B AND 21C
Sulfurized-mineral oils made by a special Gulf process to provide greater sulfur activity over a wide range of machining operations. Transparent and relatively light in color.

GULFCUT 31A AND 31C
Sulfurized-mineral-lard oils that excel in performance over a wide range of machining operations on many types of steel. Have outstanding anti-weld properties and load carrying ability. Sulfur is combined in three different forms for maximum chemical activity.

GULFCUT 41A, 41B AND 41C
Sulfo-chlorinated-lard oils for high production jobs on automatic machines. Engineered with the proper combination of sulfur, chlorine and fatty oil. They also provide proper lubrication for machine tools.

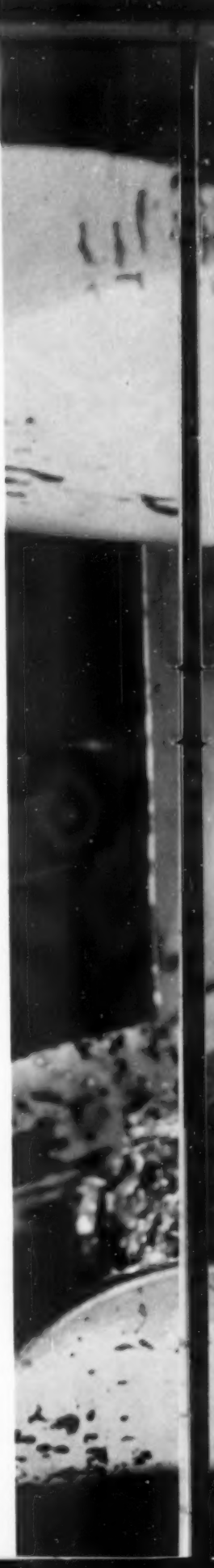
GULFCUT 41TG
Sulfo-chlorinated-lard oil specifically compounded for thread grinding operations.

GULFCUT 43A
Sulfo-chlorinated oil for high production machines requiring an oil of this type for pipe cutting and threading, screw and bolt making machines, and cutting operations on steels with free and moderate machinability characteristics. Contains a corrosion inhibitor to protect ferrous metals and machine parts.

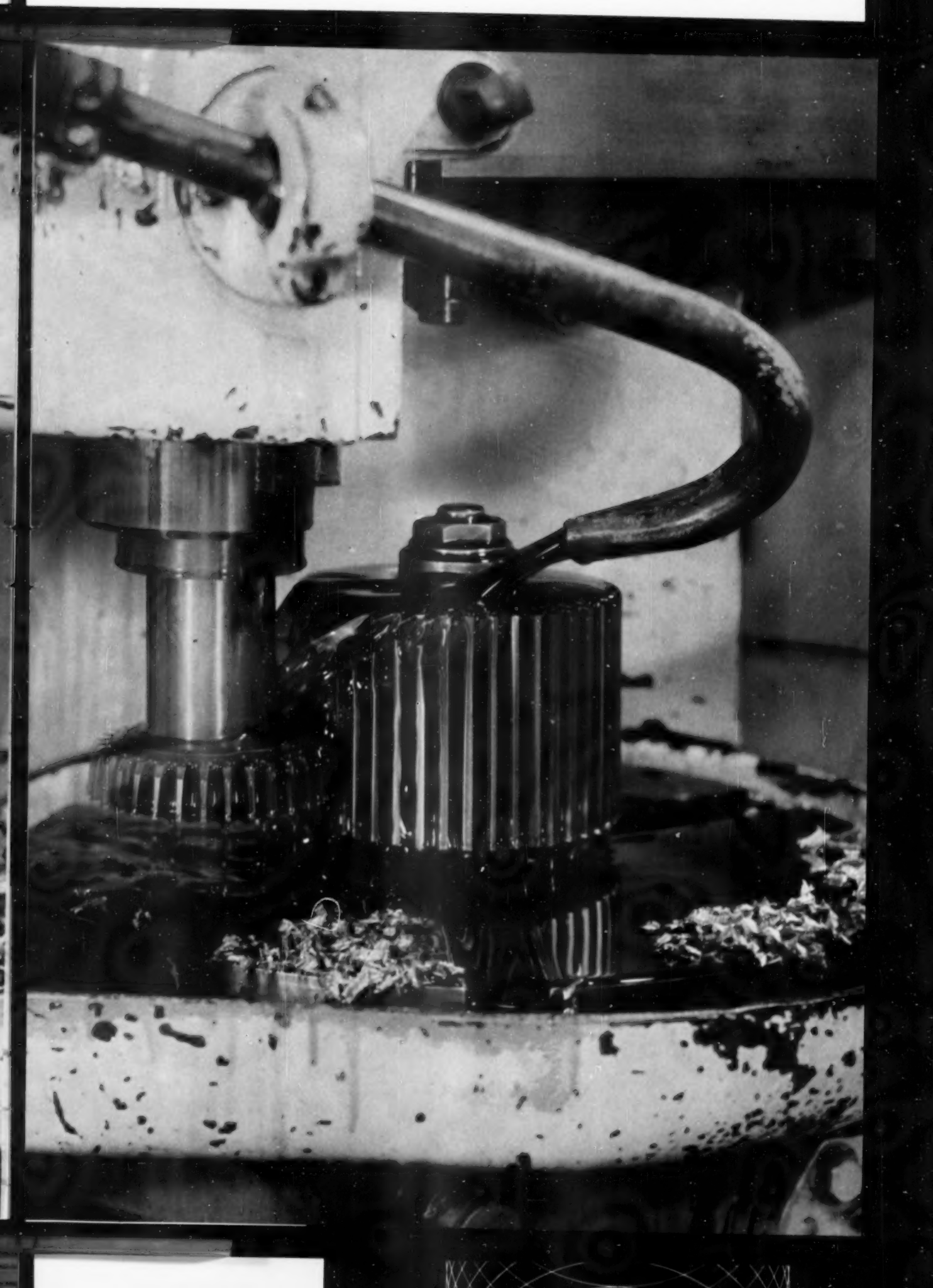
GULFCUT 43B
Specially blended sulfo-chlorinated-lard oil for high production machines requiring an oil of its viscosity and compounding. Dual purpose—suitable for machine lubrication as well as for cutting operations.

GULFCUT 45A AND 45B
High quality sulfo-chlorinated-lard oils with excellent load carrying and anti-weld characteristics to insure best results on the most difficult jobs. Have heavy concentrations of sulfur, chlorine and fatty oil. May be diluted for less difficult jobs.

GULFCUT 51A
Emulsifying oil with a wide range of uses in cutting, forming and rolling operations where a coolant with moderate lubricating properties is required. Readily mixes with warm or cold water as high as 100 to 1. Forms homogeneous and exceptionally stable emulsions.



Cutting a gear from SAE 4815 steel on Fellows Gear Shaper. Gulfcut 21-C, with relatively light color and transparency, permits close inspection of work in progress.



Machine shop at Gulf's Harmarville laboratories is a proving ground for Gulfcut cutting oils.

GULF
PETRO-ENGINEERING SERVICE

For practical technical aid, at no cost to you, call in your Gulf man. He can help you save money if you use cutting oils, lubricants, fuels, rust preventives, quenching oils, solvents, waxes or process oils. Whether you have an immediate problem—such as oil vapors, sludge or corrosion in your storage tanks, or some vital machine "running hot" —or whether you're just interested in simplifying your fuel and lubricant storage and dispensing methods . . . your Gulf Sales Engineer has a practical answer. Call him today.

MAIL THIS COUPON TODAY FOR MORE FACTS OR CONSULTATION

GULF OIL CORPORATION
1822 Gulf Building, Pittsburgh 30, Pa.

Gentlemen:

☐ Please send me your free bulletin on Gulfcut Cutting Oils.
☐ Please have a Gulf Sales Engineer call on me.

Name_____

Company_____

Title_____

Street_____

City_____ Zone_____ State_____

GULF

GULF OIL CORPORATION
1822 Gulf Building, Pittsburgh 30, Pa.

SP-8917

RUBBER-FLEX* COLLETS FOR B&S SCREW MACHINES

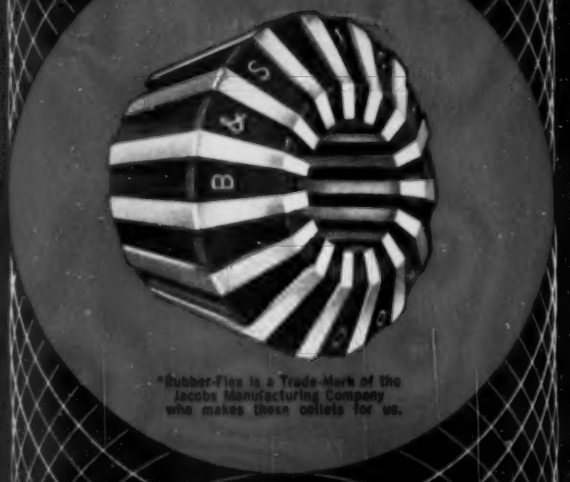
- **Grip with far greater power than spring-type collets!**
- **Maintain a new high in concentricity!**
- **Protect the spindle unit!**
- **Cut inventories as much as 65%!**

Here are collets with a grip you can trust—even on the heaviest cuts! In Rubber-Flex Collets, steel inserts permanently bonded to rubber hold the stock uniformly, firmly . . . actually *tighten* their grip as the power of the cut increases. They provide protection against slippage for all round stock jobs on Brown & Sharpe Nos. O and OG Automatics and the No. O Hand Screw Machine.

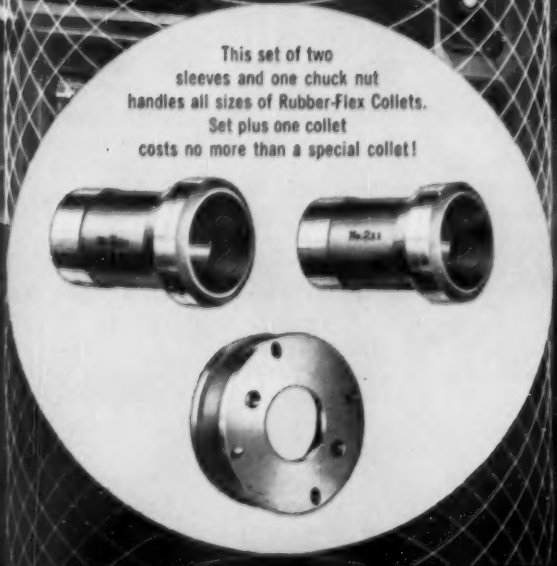
COLLETS WITH A SUPER GRIP!

The unique concentricity of Rubber-Flex Collets assures highest accuracy on the finest work. Run-out at the spindle nose is far less than with conventional equipment. What's more, collet faces seal flush against the chuck nut . . . protect the spindle unit from chip-laden coolant.

Rubber-Flex Collets eliminate the need for large inventories of individual sizes. Each collet has a range of 0.050". A set of only 13 covers the spindle capacity of any of the above machines from .100" to .750"! There's no need for "specials" . . . plenty of tolerance for over- or under-size stock. Write for full details and demonstration. Brown & Sharpe Mfg. Co., Providence, R. I.



*Rubber-Flex is a Trade-Mark of the Jacobs Manufacturing Company who makes these collets for us.



This set of two sleeves and one chuck nut handles all sizes of Rubber-Flex Collets. Set plus one collet costs no more than a special collet!

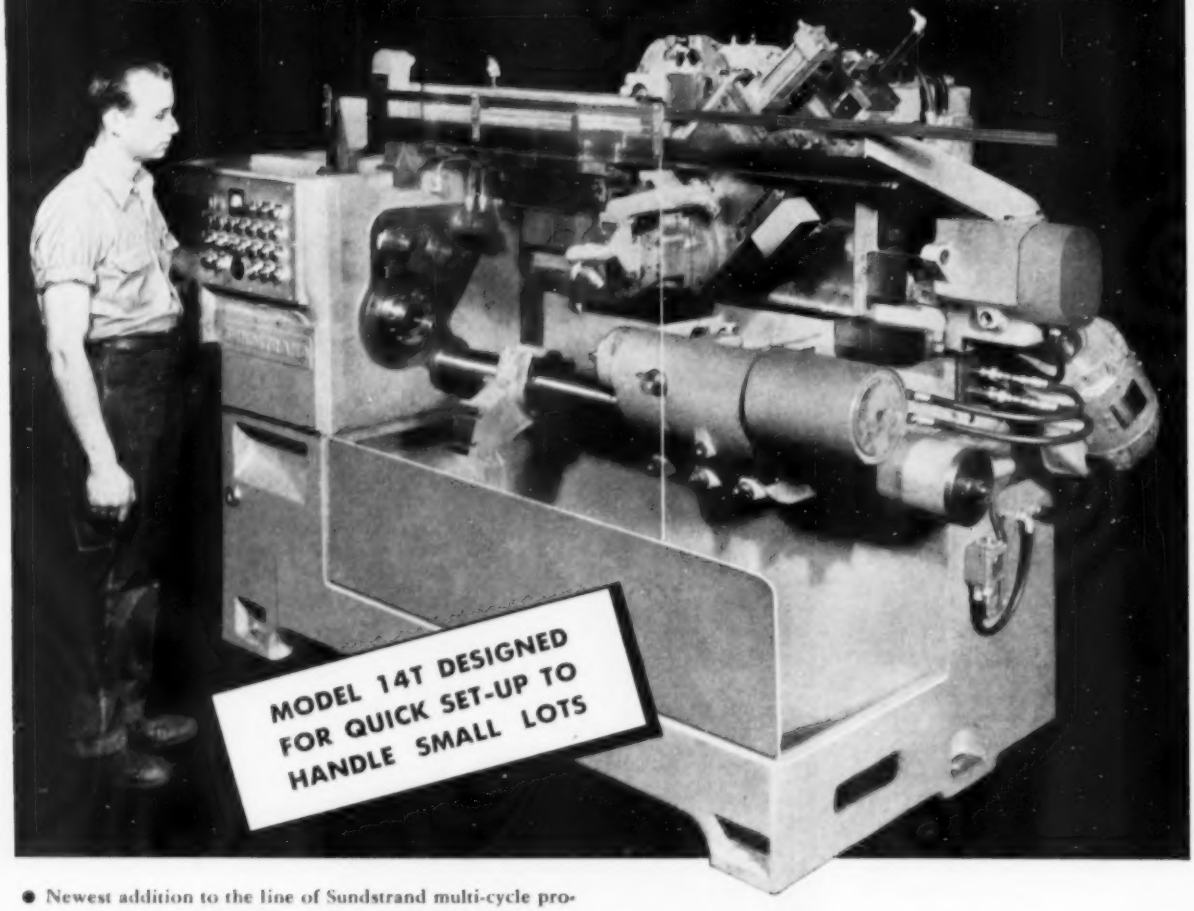
Buy Through Your Local Distributor

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES • CUTTERS • MACHINE TOOL ACCESSORIES • PRECISION TOOLS • PUMPS

NEW! SUNDSTRAND

Multi-cycle *Hydraulic* Tracer Lathe!



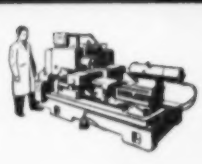
● Newest addition to the line of Sundstrand multi-cycle production lathes is the Model 14T with tracer control. Now, these 40-horsepower production lathes are available with three types of controls: hydraulic tracer, mechanical, and punch card — giving you the one best machine for your turning jobs. Hydraulic tracer control on the Model 14T makes machining of irregular shapes both fast and profitable. Only one template, readily accessible on the front of the machine, is required for multi-cycle cuts. For example, ruffing, semi-finish, and finish cuts all may be part of one automatic cycle. Shoulder facing tools can be provided where required, for squaring and similar operations.

AVAILABLE WITH 2, 4, OR 8-SPEED HEADS

Maintaining correct speeds and maximum horsepower on the Sundstrand multi-cycle lathes is assured by transmission-type heads that provide automatic speed changes. These heads are available in 2-speed, 4-speed, or 8-speed types, enabling a machine to be selected with spindle speeds ranging from 245 to 3025 rpm as best suited to production requirements of your plant.

SUNDSTRAND "Engineered Production" Service* *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

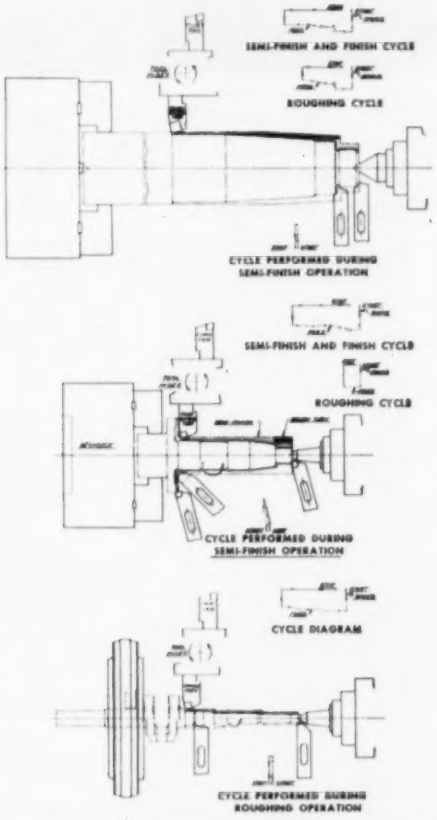


TURRET FOR RUFF AND FINISH TOOLS

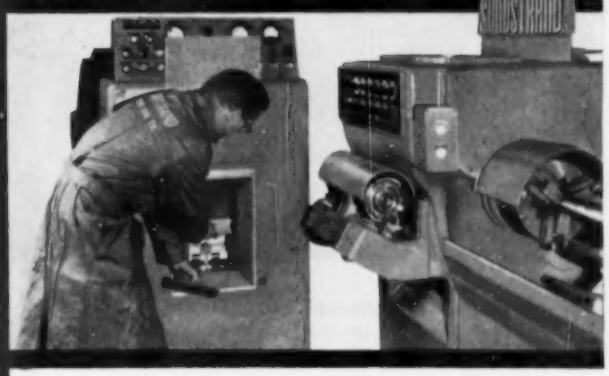
Indexing turret for turning tools provides ruff and semi-finish cuts with a ruffing tool and a finish cut with a finishing tool all in one automatic cycle.

TYPICAL TOOLING SETUPS

Jobs shown here are typical of those handled on Sundstrand Model 14 multi-cycle lathes.

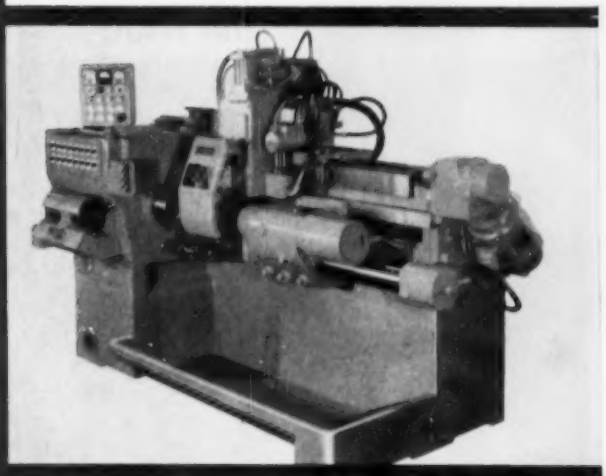


OTHER AVAILABLE TYPES



PUNCH CARD CONTROL . . .

With this system, decimal dimensions on engineering drawings are punched in standard business machine cards with a standard key punch. The cards are then fed into a reader, as shown above, which feeds the electrical signals into a machine control unit. This unit then controls all functions of the machine.



ADDITIONAL FEATURES

Here are a few additional features of Sundstrand multi-cycle lathes:

INFINITELY VARIABLE FEEDS from 7½ to 29½ inches per minute.

LARGE CHIP CAPACITY in large open cavity below facing tool carrier. Vertical ways are free from falling chips.

EASY FRONT LOADING with center line of spindle only 9 inches from front of machine.

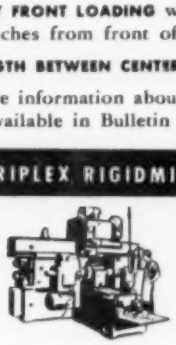
LENGTH BETWEEN CENTERS of 30, 40, 50 or 60 inches.

More information about Sundstrand multi-cycle lathes is available in Bulletin 776. Write for it today.

MECHANICAL CONTROL . . .

On the Model 14 mechanically operated machine the turning slide and shoulder facing tools are actuated independently. No template is required for step turning, and micrometer adjustment for steps is easy to set for size corrections due to material changes, etc. There is no lost motion for re-set because index takes place during cut.

TRIPLEX RIGIDMILS | SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

"Engineered Production" Service

FOR BROACHING

It takes all 3

American's *"Engineered Production"* Service . . . gives the broach user the complete three-part service required to handle a production broaching job. It adds years of design and production engineering experience, unavailable at any price, to your staff at no extra cost.

THE JOB

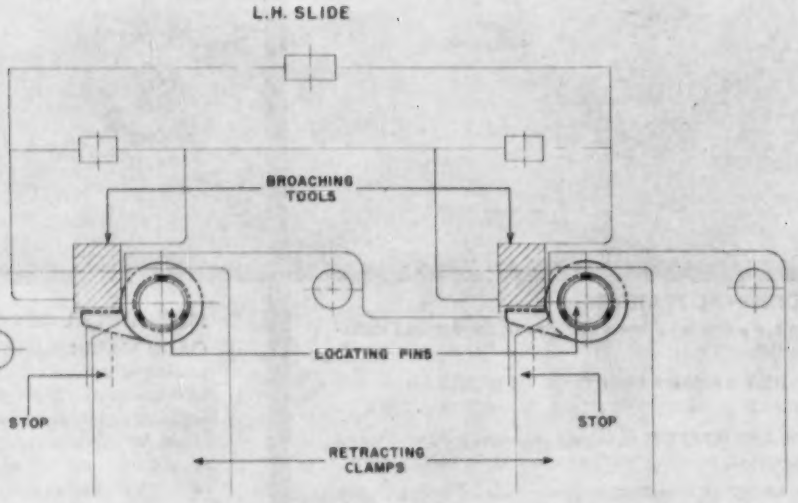
Broaching mounting face on rear wheel brake cylinders.

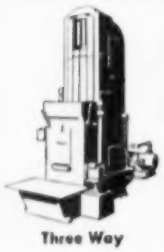
THE RESULT

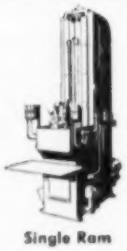
720 parts per hour broached two at a time on vertical dual-ram machine removing about ⅛ in. stock.

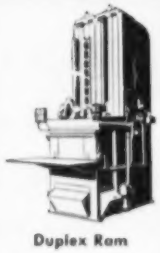
1 PROPER BROACH TOOL DESIGN

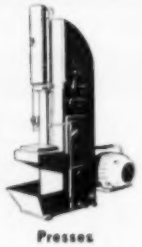
To insure top-quality results on any broaching operation the job must start with the design of the broaching tool itself. American Broach solves this all-important first step by considering: stock removal, length and width of cut, finish and tolerances required, etc. American's experience in designing and building broaches for every type of part capable of being broached pays off in quality of the work and in long tool life. You can be sure the broach and machine will operate as a team because they are designed that way.

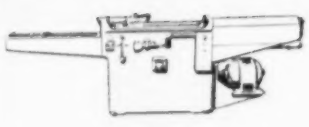



Three Way


Single Ram


Duplex Ram

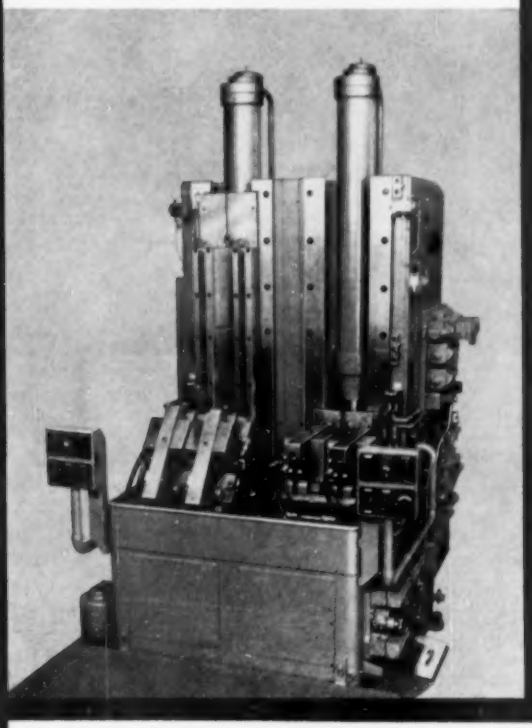

Presses


Horizontal

to give you peak broaching performance

2 SPECIFYING THE RIGHT MACHINE

At American, machine selection is made after the design of the broaching tool. Production rate required, length and speed of stroke, relationship to other production machinery, and available floor space dictate the selection of the broaching machine capable of doing the best broaching job. From a manufacturer like American, who builds a complete line of standard machines and has extensive experience on specials, you can depend on getting the most practical machine for your job.



3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. Whether manual loading and unloading is used or the work cycle is completely automatic, workholding fixtures designed and built by American Broach feature easy loading and unloading coupled with positive clamping during the broaching cycle. Even with relatively inexperienced operators, production schedules are maintained since the "skills" are built into the tool, machine, and fixtures.

WRITE for Bulletin A711 containing information on practical broaching methods by American.

SUNDSTRAND AMERICAN *American* BROACH & MACHINE CO.

A division of SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

Verson tool-up at Maytag Plant No. 2 produces a variety of parts for Automatic Washers

Two Verson hydraulics and three Verson full eccentric presses, shown above at the Maytag Plant No. 2 in Newton, Iowa, perform deep drawing, punching, forming and trimming operations on a variety of parts for the Maytag Automatic Washer. These presses, designed and engineered by Verson, were tailored to Maytag requirements to be a part of the complete manufacturing program.

All Verson presses represent the ultimate in press design. But, more important, they are engineered, not only as presses, but as integral parts of your production process.

Take advantage of Verson's experience and facilities and put real production know-how to work for you. Send an outline of your requirements today. We will be happy to make specific recommendations.

A Verson Press for every job from 60 tons up.

Verson

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

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MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-66

61 models

A machine not put to its best use is theoretically idle. Proper machine selection is an important factor in the profitable use of a multiple spindle automatic. So extensive are the demands on this type of lathe that no single model—or number of models—can be expected to efficiently handle the wide range of work available.

To excel in any range of work a multiple spindle automatic must be specifically designed for that range. That is why CONOMATICS are provided in so many models. In no other way can the purchaser be assured of the best possible machine for his particular requirements.

Write for your copy Today

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

NEW—from

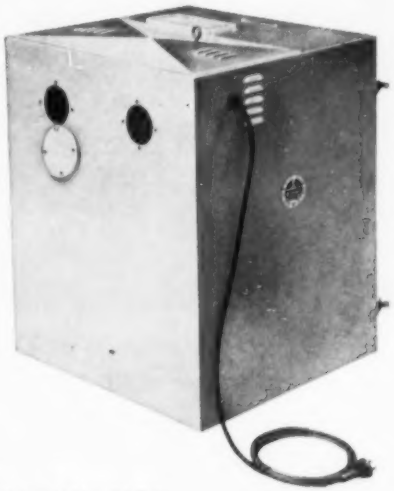
WALKER-TURNER

The finest precision grinders ever built—the new Walker-Turner "Light-Heavyweights". Designed to do the most exacting grinding operations *quickly* and *economically*, and save you time and money. Low initial cost, positive accuracy, and advanced safety features make Walker-Turner Grinders ideal for your plant.

Ask your Walker-Turner distributor to demonstrate the superior advantages of these versatile grinders and other famous Walker-Turner tools. Mail the coupon below for complete information.

NEW WALKER-TURNER
6" CARBIDE TOOL GRINDER

. . . keeps your carbide-tipped cutting tools at peak efficiency. Vibration-free operation assures true grinding. Tables tilt to permit wet or dry grinding at any angle.



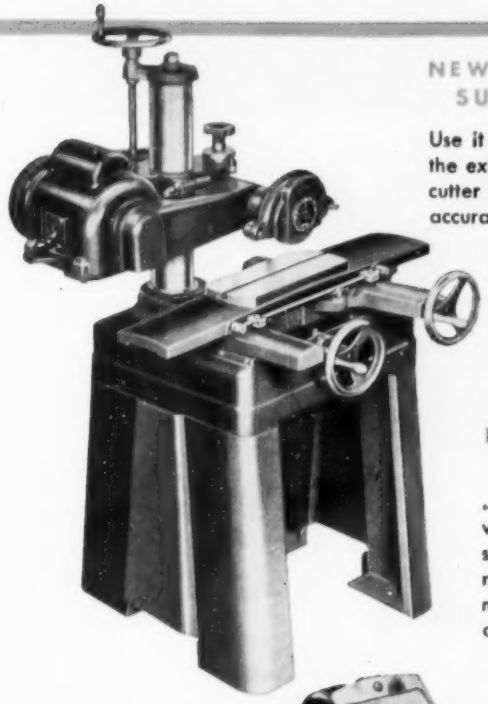
NEW WALKER-TURNER
DUST COLLECTOR

. . . has strong, pressed steel cabinet, removable filter, enclosed ⅓ H.P. motor and fan that moves 350 cubic feet of air per minute. Unit is compact and portable.

A complete line of "Light-Heavyweight"

GRINDERS

to bring you New production economies



NEW WALKER-TURNER
SURFACE GRINDER

Use it as a big capacity grinder that offers you the *extra* ability to do chip-breaker and tool and cutter grinding. You get simple set-up, precision accuracy, *AND* surprisingly low cost.

NEW WALKER-TURNER
7" TOOL GRINDER

. . . combines positive accuracy with advanced safety features. You get dual shatterproof-glass eye shields, engineered wheel guards, dust chutes, removable steel side plates, and adjustable spark deflectors.

NEW WALKER-TURNER
6" BENCH GRINDER

. . . takes up minimum space for grinding, polishing and buffing. Balanced grinding wheels and precision ground shaft provide smooth, accurate performance.

walker-Turner

WALKER-TURNER
Division of Rockwell Manufacturing Co.,
Dept. WB-25, 400 North Lexington Ave., Pittsburgh 8, Pa.

( ) Please send name of my Walker-Turner distributor.
( ) Please send literature on Walker-Turner Grinders.

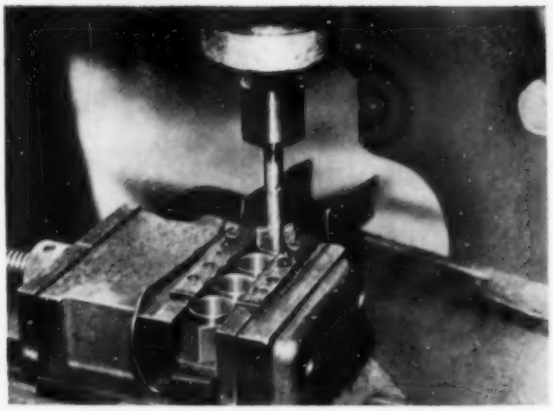
Name_____

Address_____

City_____ Zone____ State_____

OSBORN BRUSHING METHODS worthy of your confidence

Removing chips and burrs from threads with Osborn Situfix Brushes assures a good fit.



Before Brushing

After Brushing

Cleaning up... when the chips are down

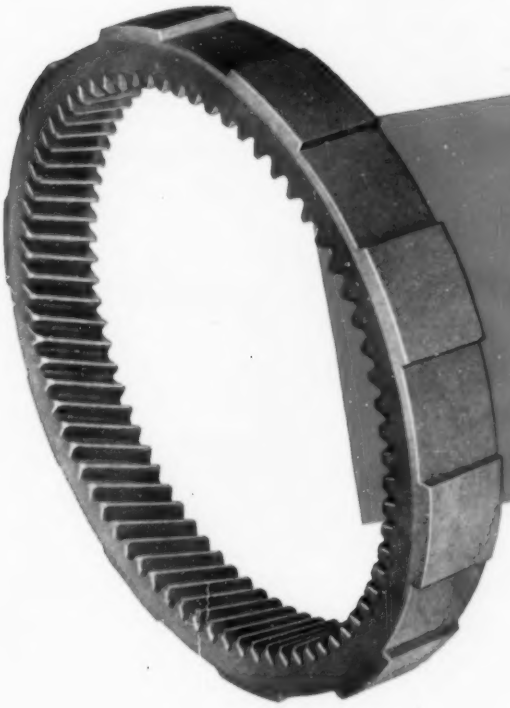
In precision tapping, tiny abrasive chips and burrs deep down in the threads can be removed easily to assure close fit and prevent excessive wear on thread gages.

Osborn power brushing performs this operation quickly and efficiently with the simplest of equipment. Rejects, a profit-taker for any company, are cut to a minimum.

An **O**sborn **B**rushing **A**nalysis, made in your plant without obligation, may point out a number of ways Osborn power brushing can improve your metal finishing operations. For details, write *The Osborn Manufacturing Company, Department K-31, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

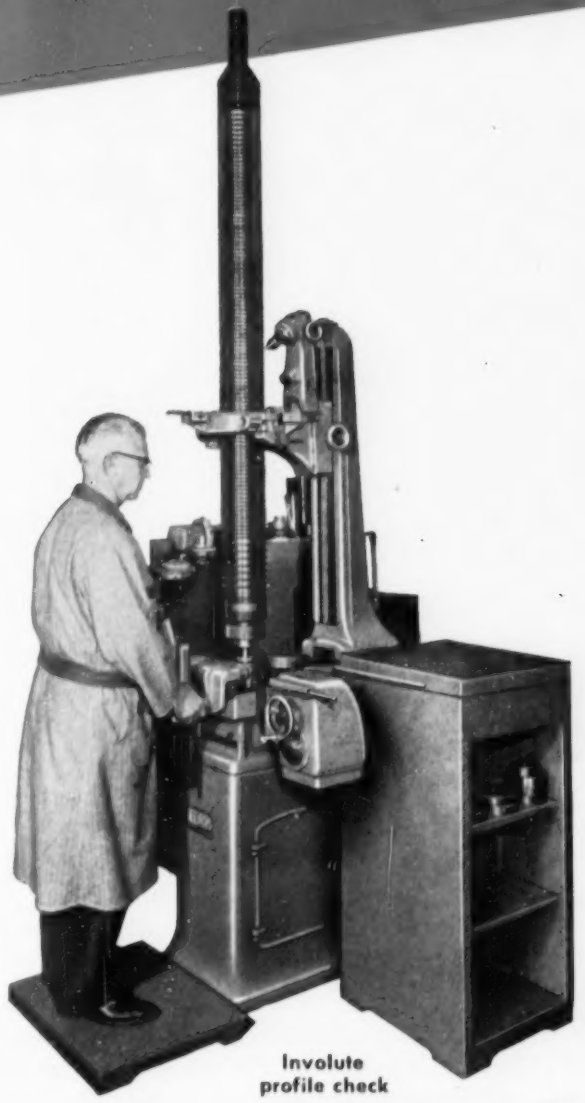


WHY YOU GET BETTER HIGH SPEED INTERNAL GEARS AT MINIMUM COST WITH RED RING NALOY BROACHES

- Gear is completely cut from the solid blank in just one pass. A quick shaving operation or a finish broaching pass completes it.
- Critical gear characteristics held to tolerances of .0002".
- All gears produced are interchangeable regardless of the number of broaching tools in use.

The secret of combining spectacular economy with such high gear precision lies in the broaching tools themselves. Special manufacturing processes are used. Each is under the constant control of Red Ring metallurgists and engineers in this company's own plant.

The real proof of Red Ring methods is reflected in actual performance figures. Ask to see them.



Involute profile check

7680

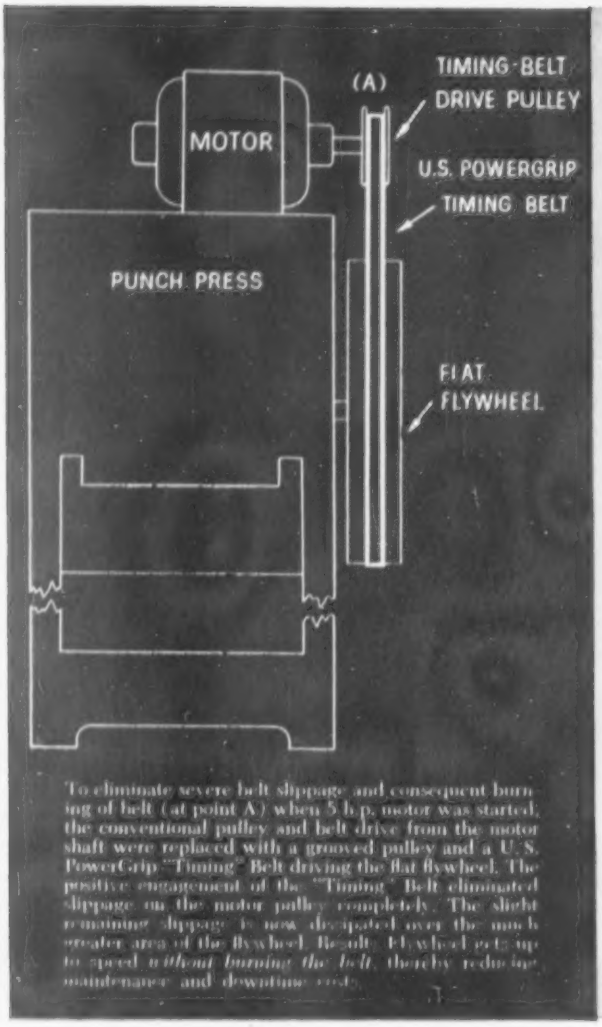
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

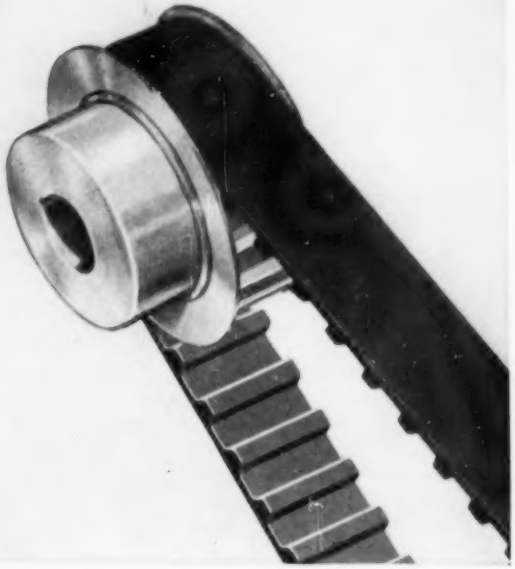
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

PowerGrip "Timing" Belts



To eliminate severe belt slippage and consequent burning of belt (at point A) when 5 h.p. motor was started, the conventional pulley and belt drive from the motor shaft were replaced with a grooved pulley and a U.S. PowerGrip "Timing" Belt driving the flat flywheel. The positive engagement of the "Timing" Belt eliminated slippage on the motor pulley completely. The slight remaining slippage is now dissipated over the much greater area of the flywheel. Result: Flywheel gets up to speed *without burning the belt*, thereby reducing maintenance and downtime costs.

How a plant engineer made this press deliver a better punch



This is one more example of the U.S. PowerGrip "Timing"® Belt's ability to simplify and improve a power transmission unit . . . one of the reasons why the invention of this belt was recently awarded the Franklin Institute's Edward Longstreth Medal for "Invention of High Order."

Whether it's a plant conversion or original equipment design problem, U.S. PowerGrip "Timing" Belts offer the plant and design engineer all these advantages:

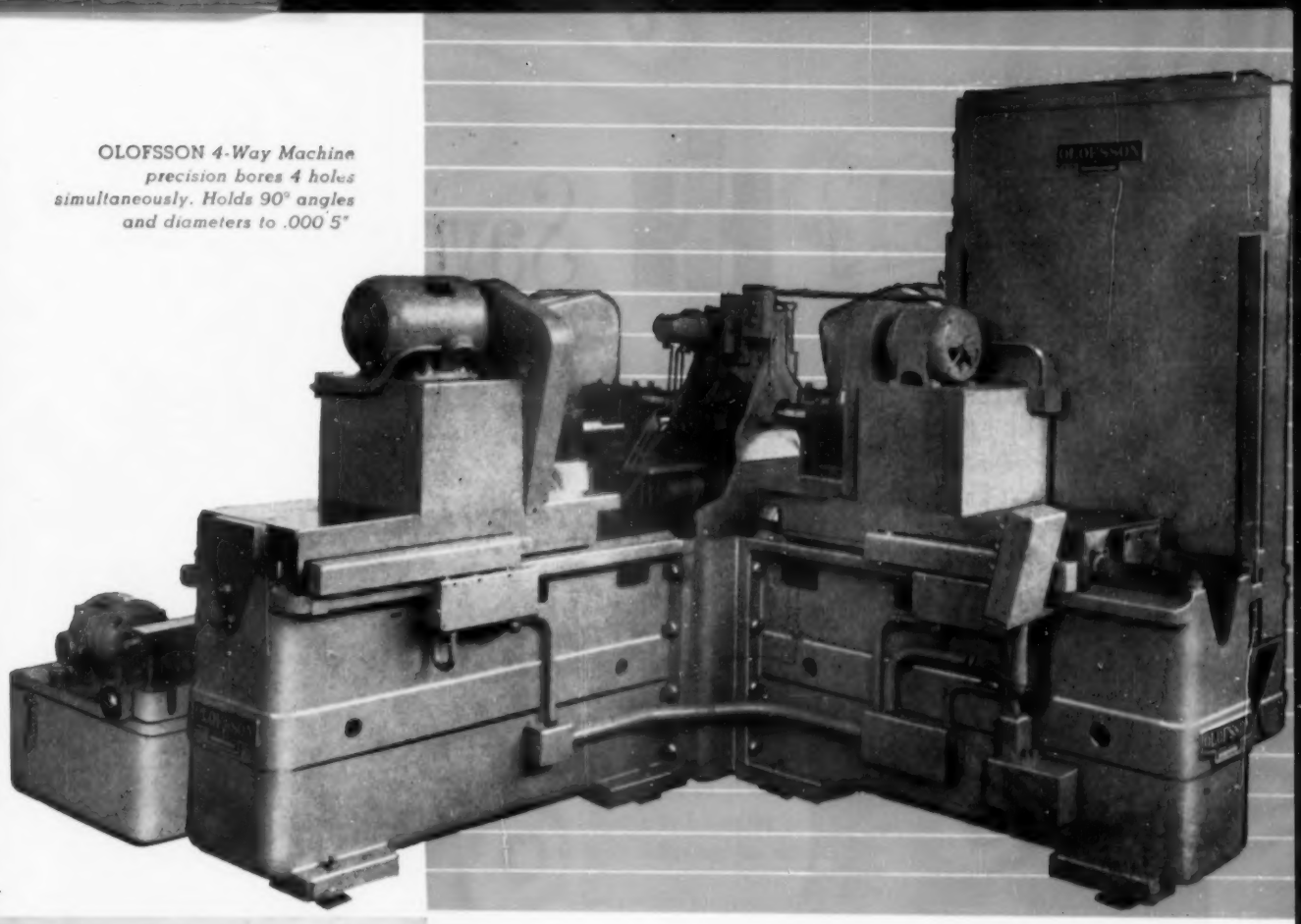
- *no slippage, no take-up—allows short centers, high ratios.*
- *absence of metal-to-metal contact—eliminates need for lubrication and housing devices.*
- *handles speeds up to 16,000 F.P.M. or so slow as to be imperceptible to the eye.*
- *close to 100% efficiency.*
- *imbedded with steel cables for high tensile strength.*
- *constant angular velocity.*

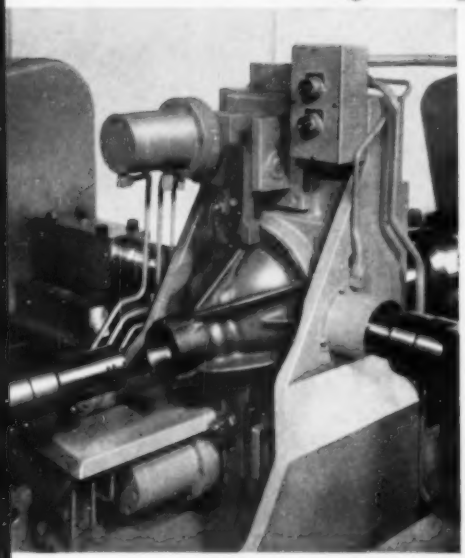
These belts—plus expert engineering service—are obtainable at "U.S." power transmission distributors, at any of the 28 "U.S." District Offices, or by writing us at Rockefeller Center, New York 20, N. Y.

Mechanical Goods Division

United States Rubber

OLOFSSON *4-Way Machine precision bores 4 holes simultaneously. Holds 90° angles and diameters to .000 5"*





Close-up view of differential carrier, hydraulically cam-clamped in position for boring.

for MORE production and precision, combine 1, 2, 3, or 4 OLOFSSON way units in any COMBINATION

OLOFSSON Precision Way Machines perform fast, accurate boring, facing, turning, grooving, and chamfering. Units are electrically interlocked, and the spindles move to the work.

For long, dependable, and accurate operation Olofsson Way Units feature:

- **Single push-button control panel.**
- **Hardened and ground V-style ways.**
- **Hydraulic control Valves, manifold mounted and located with reservoir.**
- **Parker Majestic precision boring spindle.**
- **Rigid ribbed, nickle iron base.**
- **Adherence to latest J.I.C. recommendations.**
- **Hydraulic pump units located outside base.**
- **Automatic central lubrication system.**
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The Tool Engineer

Professional Standards

Since National Engineers' Week falls in this month, it is an appropriate time to consider our profession. We salute the thousands of engineers of the past and the present who have dedicated themselves to the building of a better engineering profession!

Sir Francis Bacon expressed this thought—"I hold every man a debtor to his profession; from which as men of course do seek to receive countenance and profit, so ought they of duty to endeavor themselves by way of amends to be a help and ornament thereunto." Establishing and meeting professional standards is the minimum we can do in following his advice.

What are the professional standards for engineers? They are generally recognized as graduation from an engineering college of recognized standing and/or registration as a professional engineer. It may be strongly argued that there are many well-qualified and ethical engineers who are practicing without benefit of either graduation or registration. This does not discredit the standards. ASTE's professional engineering committee, at the national and chapter level, has been earnestly working with and for such engineers to help them become registered.

Engineering societies too are judged by professional standards predicated, to a large degree, on those for the individual engineer. A strong desire on the part of our membership can make possible greater professional recognition of our society. This, in turn, would enhance membership in ASTE.

Let us do our part, as a society and as individual engineers, to help build the engineering profession.

H. C. McMillen

PRESIDENT

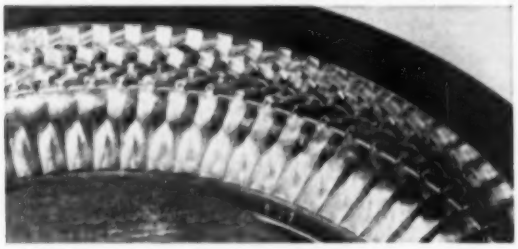
STEEL MACHINING CASE STUDY

How $30 worth of steel plate took the risk out of a $4000 machining job!

There's a quick, sure way to select exactly the right steel—whatever your particular application. Draw on the wide experience of Ryerson specialists who are working with hundreds of other steel users on similar problems every day. The right steel can make a big difference—can mean a better product, lower production costs—as the following case study illustrates.

THE PROBLEM—Central Mold & Machine Company of Akron contracted to make a chrome-plated mold for producing an exact duplicate, in miniature, of Firestone's new Supreme tubeless tire.

Only a very small piece of plate steel was needed for the job—but the steel had to be extraordinarily clean and sound. Hundreds of hours of machining time were to be "invested" in it and some of the tiny lands that formed the unusually intricate tread design were only .015 of an inch thick!



A close up of the mold for the 6" tire showing intricate machining with lands only .015" thick.

SOLUTION—Working with a Ryerson representative, Central Mold & Machine selected New E-Z-Cut plate for the job. Because this Ryerson leaded plate steel is remarkably clean and free of excessive stringers, even the finest lands of the mold were sharp and true. Because New E-Z-Cut machines as much as 30% faster than mild steel plate, the difficult machining job was completed in minimum time. And because New E-Z-Cut machines to a high finish and polishes readily, the mold was very satisfactorily prepared for plating, at low cost.

If a better quality free-machining plate had been available at any price it would have been used here because, at almost any price, the cost of the steel would be only a tiny fraction of the cost of the finished mold. New E-Z-Cut (approximately $30.00 worth) was used because it took the steel risk out of a $4000 machining job.

Whatever your steel problem, it will pay you to check with Ryerson specialists and draw on Ryerson stocks of highest quality, special purpose steels.

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All New E-Z-Cut plates are 84" wide, and may be sheared or flame cut to your specifications. We have both single torch equipment and multiple-torch electric eye machines for flame-cutting a single special shape or many duplicates. Please call or send in your drawings for prompt quotation.

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Training on the job is demonstrated by group discussing tooling problem: left to right, graduate engineer, draftsman, cage tool design supervisor, cooperative engineering students and student draftsman.

to relieve engineering shortage

...train company employees

By Harley Urbach*
Executive Engineer
Timken Roller Bearing Co.
Canton, Ohio

Industry sometimes is skeptical of cooperative ventures in education, because often a firm's efforts seem to result only in training technical people for others—even competition. The author's company, however, has found a way to get more positive results. Their program should prove highly significant to engineers as well as administrators.

MANY SUGGESTIONS are being made to solve the shortage of engineering graduates. Often these proposals fail because of practical realities. Basically, they should increase a firm's fund of engineering talent. With this criterion in mind, the Timken Roller Bearing Company has developed a plan to tap a stable source of potential talent—qualified personnel now in its employ.

This approach affords many advantages to both the company and the employee. To the company it gives assurance of loyalty and continuity of service. To the employee it offers an unprecedented opportunity. Both benefit from the background of work experience that is one of the prime requisites of the plan.

Any training program to be successful must be

*Senior member ASTE Canton chapter.

Engineering Technician Curriculum

1st Quarter

College Algebra
Trigonometry I
Engineering Drawing I
General Chemistry I

2nd Quarter

Calculus & Analytical Geometry I
Descriptive Geometry
College Physics I
General Chemistry II

3rd Quarter

Calculus & Analytical Geometry II
College Physics II
Engineering Drawing II
Trigonometry II
Engineering Metallurgy

4th Quarter

Calculus & Analytical Geometry III
Mechanics I
Materials, Processing & Equipment
Electrical Engineering

5th Quarter

Industrial Engineering
Mechanics II
Fluid Mechanics
Mechanisms

6th Quarter

Tool Engineering
Machine Design I
Mechanics III
Strength of Materials

tailored to a company's needs and its organization. Because precision is one of the essential qualities of its products, Timken depends on engineers and technical personnel as the backbone of its organization. In fact, many company executives are engineers.

Engineers are widely employed in production departments on supervision and in industrial engineering. A large number of engineers are engaged in the metallurgical department which supplies technical services to all divisions of the company. Mechanical and electrical engineers are employed extensively in sales, where engineering of applications is an important part of the work. The engineering division embraces product design, tool engineering, process equipment, maintenance of production equipment, works engineering, physical laboratory and product application engineering. In addition, there is the development and research department with broad responsibilities for new product designs and testing, as well as the process and equipment for initiating manufacture. The policy of promotion from within the ranks further underscores the need for sound technical education in employees of leadership potential.

Since it has been impossible to secure all the engineering graduates needed, positive steps to supplement this source must be taken. The company already had a well-rounded training program in operation. This extends from apprenticeship level through executive development, including concentrated courses of 4 to 13 weeks at one of a number of outstanding universities.

With the general framework of employee training well established, the company set out to pioneer a new plan. Basically, the idea was to pay the complete cost of engineering education for qualified employees. Cooperating in the venture is Tri-State College, Angola, Indiana.

How The Plan Works

Briefly the plan is a company-sponsored cooperative program in which the employee-student attends school alternate quarters and works at a job in the engineering department during intervening quarters. While at school the employee continues to receive full pay, as well as other benefits such as hospitalization insurance, etc.

Prior to beginning the first school term, the student signs a noninterest-bearing note for the amount of his salary during the quarter he is in school. This note will be due and payable on the first day of the month following the month in which the employee-student finishes his course. This may be four, five or six quarters.

When the employee completes a year of service with the company, the note for the first quarter's schooling is canceled. Every year of service thereafter results in cancellation of another note until all four, five or six are canceled.

Qualifications for applicants are set to insure success both in the academic course and in engineering careers in the company afterwards. First is the requirement for at least one year's service with the company. Then, too, the applicant must have an outstanding merit rating, be recommended by his supervisor and have a high school diploma. Also, high school mathematics and science credits are required.

Employee-students work in pairs, as in many "co-op" plans. One is at school while the other is on the job. Thus, a minimum of two would be selected from any one department. While it was expected that most students would come from the apprentice program, in the first group of twenty, several departments were represented. These included electrical maintenance, production, steel machining and the drafting section of engineering.

The first class of 10 began their academic work on June 11. They were back on the job September 24 to replace their alternates who started their first quarter of engineering schooling at that time.

Students must carry at least 20 credit hours of

work per quarter while at school and maintain an average of *C* or better. A typical six-quarter curriculum, shown listed on this page, includes college mathematics, engineering drawing, physics, materials and processing, tool engineering and machine design. Completion of the intensive curriculum will lead to an engineering technician certificate.

The program, however, is still in formative stages. Accent is strictly on practical aspects and the curriculum may be modified to tailor it to the background and experience of each employee. As many aspects of engineering are encompassed under a vice president in charge of engineering, the engineering training program likewise reflects the many-faceted functions of the company's total engineering program. The result expected is a broad knowledge of production requirements in product designers and acquaintance with product design problems among tool engineers.

While it is too early to evaluate the program and all its possibilities, it is anticipated that the plan will be expanded in the future to include other schools and other engineering subjects. As a matter of fact, this may be just the beginning for both the company and student. After completion of this basic work, it is possible for him to go on to secure his degree through other company training programs.

One of the possibilities for continued study is through night school courses in engineering, sponsored in cooperation with other firms in the Canton area. In addition the company also participates in cooperative engineering programs with the University of Cincinnati and Georgia Tech.

To participate in this latter program an applicant must have been in the upper third of his high school class, with averages of 33 or better. Although programs vary somewhat, each requires five years to complete. As with the engineering technician plan, the co-op student must have been employed in the company for one year before enrolling, usually in the engineering division.

The individual pays for his own college expenses, although he is continued on the inactive payroll and thus benefits from the company insurance program. The candidate receives the prevailing salary for high school graduates for his working periods, but his salary is increased each year upon satisfactory completion of a scheduled portion of his college course and work experience.

During the first year's work in the engineering division, the co-op goes through a training school program in which he learns and practices mathematics and drafting. Also he gets practical training in departmental operations under engineering department group leadership.

During other cooperative work periods at the company, he participates in a four-week shop training program in which he learns about basic shop machinery and manufacturing processes. He

Student at Tri-State inspects gear cutter profile (left) on an industrial comparator in the mechanical measurements lab.

Strength testing complements classroom theory at Tri-State (above). Comparatively small classes allow individual instruction.

Discussing manufacturing layout are (left to right): chief works engineer, graduate engineer trainee, student draftsman and the chief mechanical engineer.

Machine shop apprentice makes milling setup (below). Shop training is included in engineering development program.

also may attend special training movies and classes as do graduate engineering trainees in the company. He moves from group to group within engineering, so that he learns the functions of the whole department. As the student progresses through college and in his work, he is given increasing responsibilities, based on his merit rating and practical, as well as theoretical, accomplishments.

After securing his degree, the young engineer embarks upon the company's graduate engineering training program. He is given one year's credit in this program because of his co-op experience. This graduate training program lasts from two to four years, depending upon previous experience and other conditions. It is divided into three phases.

The first is training in the department or group within the department to which the trainee is assigned. This is supervised by the engineer in charge of the group.

The second phase is general training within the engineering division. In this the trainee learns about engineering operations as a whole, including manufacturing.

The third part is professional development outside the company. This includes special courses given by colleges and other organizations. Included in this phase may be preparatory work needed to qualify for the professional engineer's rating. In addition to this the company also encourages joining and participating in technical society activities, presenting papers and writing for professional publications.

Special courses recommended may include accounting, electronics, human relations, labor relations, letter writing, junior executive development, metallurgy and machinability of metals, quality control and welding. Groups also are organized to see technical movies and hear lectures on subjects related to their training.

This training schedule affords considerable flexibility and a growth in work assignments. Young engineers are moved through the various groups and departments as work loads and vacancies permit. They also progress through grade levels of work as fast as they can qualify for more advanced assignments.

The basic purpose of this program is to produce a technical corps to carry on engineering operations and from which supervisors may be selected as

required. Obviously graduates, because of broad training and outstanding qualifications, are afforded unusual opportunities for advancement. All promotions, however, are based on merit, after completion of the training period.

For engineering in all its phases, draftsmen and other technicians are in virtually as great a demand as graduate engineers. To round out its training program, the company has for some time operated a student drafting training plan.

The student draftsman, to be selected, must be a high school graduate and of good character. He should be at least in the upper half of his class and have studied mathematics through plane geometry.

The student draftsman's first training is classroom work in mathematics and drafting. Courses missed in high school can be credited by a special testing arrangement with the Canton school system. After classroom work is completed the trainee is assigned to a group within engineering. The group leader instructs him in the group assignment; then the trainee moves to another group, until he learns about the functions of the entire department.

This program is more or less the engineering counterpart of shop apprentice training. The drafting training program can be completed in six years, at which time the trainee becomes a full-fledged draftsman.

Drafting trainees receive annual increases in salary, based on satisfactory progress, practical and theoretical knowledge and merit rating. After completion of the program they are also permitted to switch to one of the more advanced engineering educational programs, if they show unusual ability and aptitude. Also it is possible by means of the training program and outside college courses to earn an engineering degree while on the job. Then the draftsman would be enrolled in the graduate engineering training program.

Women with aptitude in drawing and mathematics are also accepted as drafting trainees. Although their program may be somewhat less ambitious, depending upon ability exhibited, no distinction is made in job titles between men and women draftsmen. They are eligible for the same training, promotional and salary opportunities as men.

Obviously, in all of these programs one common element is stressed; namely, on-the-job training. Opportunities are limited only by the ability, ambition and inclinations of the employee. The value of such a practical plan has been demonstrated many times. It provides opportunity for advancement. Supervisors in every department have come up through one of the programs described. All of the executive and supervisory positions in the company, including the presidency, are filled by men who have risen through the ranks.

Engineers, trainees and technicians work together on the job at Timken. Group includes graduate engineer trainee, co-op trainee, design supervisor, graduate engineer trainee and woman draftsman.

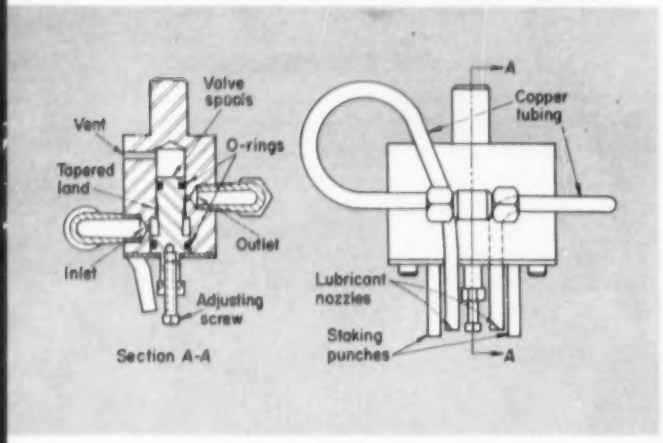
Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Combination Staking Punch and Lubricator

In assembling a small mechanism, two rivets were staked in one operation and lubricant was applied in a subsequent operation. An investigation showed that the lubricating operation could be performed at the same time the rivets were staked. The tool built to perform these combined operations is shown in the accompanying drawing.

The body of the punch holder is sufficiently large to incorporate a valve spool as shown in section A-A. The chamber formed between the lower land of the valve spool and the valve body is connected to a tank which holds lubricant under constant pressure from the shop air line. Since the diameter of the lower portion of the valve spool is larger than that of the upper portion, the pressure of the lubricant tends to hold the valve spool down.



During the staking operation, an adjustable screw in the end of the valve spool comes into contact with the assembly being lubricated, lifting the valve spool. This connects the inlet and outlet passages, shooting lubricant out the nozzles. By adjusting the length of the screw the height of the spool can be regulated and, since the outlet is opposite the tapered land of the valve screw, an accurate adjustment can be made of the amount of lubricant delivered. A vent hole at the top of the bore allows trapped air to escape and disposes of any leakage past the top O-ring.

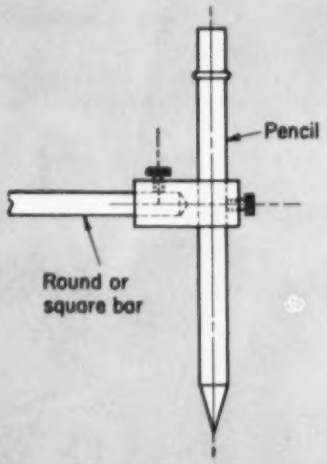
Units of this type have been in operation for several years and have completely eliminated the time previously required for lubrication. Several hundred thousand assemblies are produced before the valve body and valve spool must be replaced.

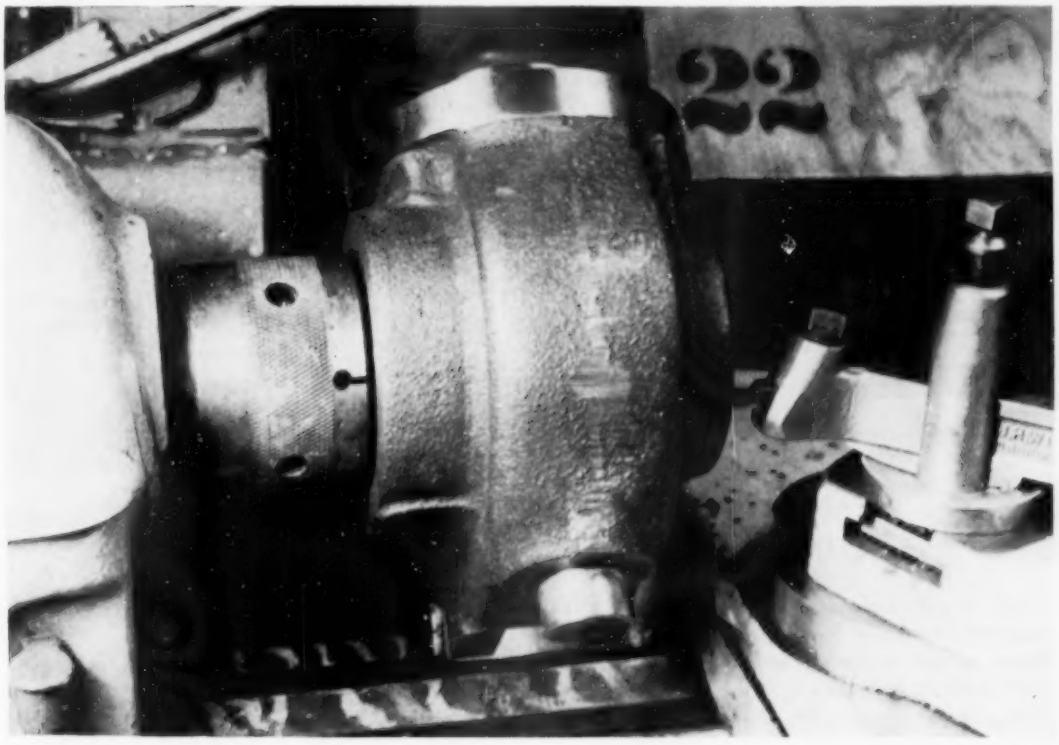
P. H. Winter
Syracuse, N. Y.

Extension for Beam Compass

When drawing red lines with the aid of a beam compass, the usual practice is to use red lead inserted in the beam chuck. Red lead is hard to work with because of its softness and large diameter. Better work can be done with a red pencil. The device illustrated makes it possible to use a red pencil with a beam compass, eliminating the disadvantages of drawing with red lead. It consists of an extension which fits onto the end of the beam, with a hole of suitable size to accommodate a pencil. The extension is held in place on the beam by means of a setscrew.

E. E. Woodman
Buffalo, N. Y.



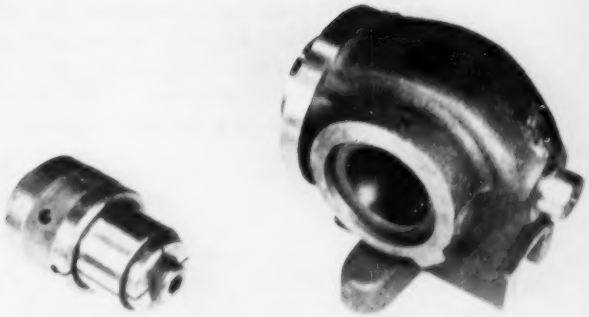


Precision Expanding Stub Mandrel

Counterboring and facing operations on small castings are accurately performed on an engine lathe, using the expanding stub mandrel illustrated. The mandrel is made of low carbon steel. It is first bored and threaded to fit the spindle nose of the lathe on which it is to be used. Next it is threaded on the spindle nose of the lathe and turned to the required size, with an allowance for hardening and grinding. An axial hole, to tap drill size for a ⅜-inch pipe thread, is drilled completely through the mandrel. The outer end of this hole is tapped for a standard hardened pipe plug and the mandrel is set up on a milling machine for slotting. Four equally spaced slots are milled through to the axial hole and the mandrel is then pack hardened.

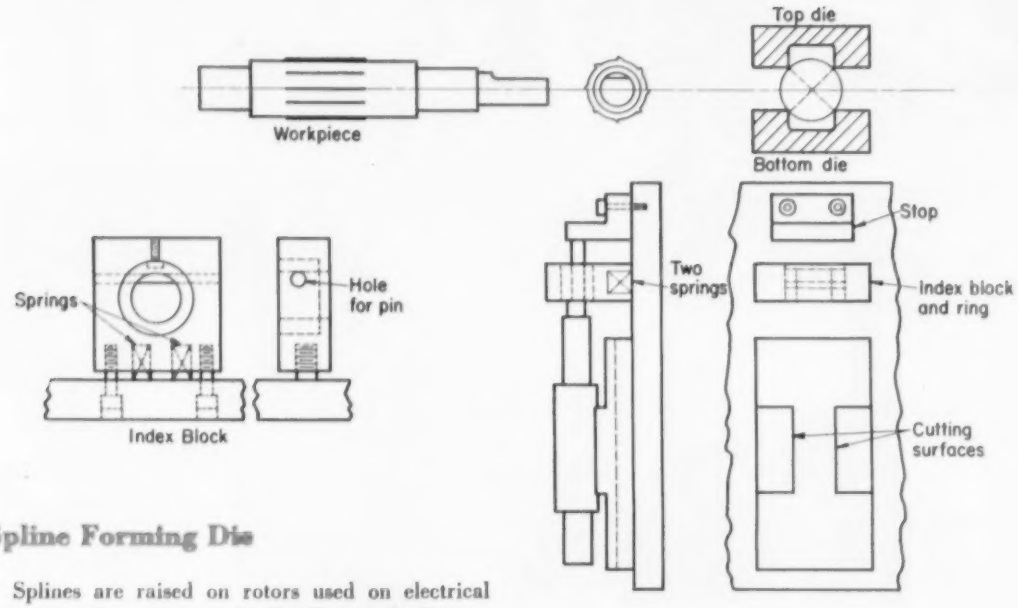
After hardening, the mandrel is threaded on the spindle nose of the same lathe used previously and all working surfaces are ground to size, utilizing a tool post grinder. The OD is then ground to fit snugly on the bores of the castings.

In operation, the casting is placed on the mandrel and the pipe plug is tightened to grip the bore of the casting, which has been ground and honed to size in a previous operation. Shop experience has shown that close concentricity and squareness limits can be held when this mandrel is used.



H. J. Gerber
Member at Large
Stillwater, Okla.

Gadgets

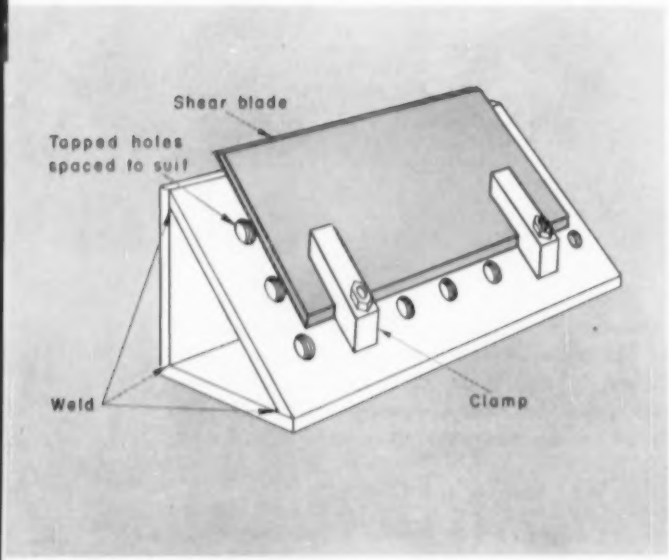


Spline Forming Die

Splines are raised on rotors used on electrical equipment by means of the die illustrated. Ninety-degree corners on the top and bottom die sections raise metal at four points on the diameter of the shaft with one press stroke. The shaft is rotated 45 degrees to complete four additional serrations.

In order to insure precise indexing, the pulley end of the shaft is fitted into an indexing ring. Pins hold the indexing block in alignment and compression springs allow it to move downward as the splines are formed, also serving to cushion the shock. A key pin is inserted in holes in the index block to hold the shaft at the required angles.

Charles Spicer
Grand River Valley Chapter

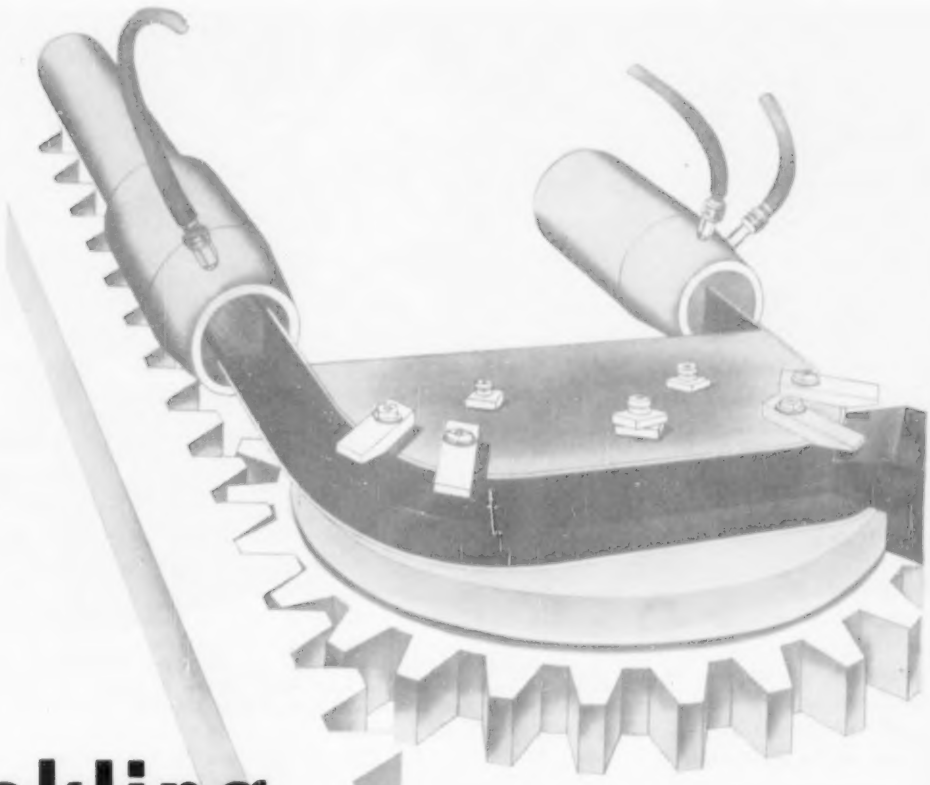


Jig for Grinding Shear Blade Edges

High accuracy in grinding shear blade edges can be obtained through use of the jig illustrated. The jig, which can be quickly set up, is made from three pieces of cold-rolled steel, cut to the desired lengths and tack-welded together. Holes are drilled and tapped in the top plate of the jig prior to assembly. These holes accommodate cap screws used in tightening down the clamps which hold the workpiece. After welding, the jig can be trued by grinding all surfaces. This will correct any warping caused by welding.

In operation, the jig is placed on the chuck of a surface grinder and a shear blade is clamped to the jig. The blade should be as square as possible with the chuck to insure accurate grinding and a good finish. The jig has proved to be highly satisfactory in service.

Frank L. Rush
Columbus, Ohio



buckling limits in CONTOUR FORMING

part one

By William W. Wood
Manufacturing Research Engineering Dept.
Chance Vought Aircraft, Inc.
Dallas, Tex.

When forming curved flanges, plate buckling is the primary cause of failure. The author analyzes this and other types of failure, describes the factors which lead to buckling and shows how formability indexes have been developed for a number of materials commonly used in aircraft design.

IN FORMING contoured sheet metal parts, almost any conceivable shape can be produced if a sufficiently long series of operations is used. Practical economic considerations, however, dictate the use of not more than two or three forming operations on most aircraft parts. If excessively high formability limits are assumed when a part is designed, it may be necessary to redesign and retool the part before it can be produced. Added cost can be avoided if forming limitations of single operations are understood.

Interpretation of Failure: Most contour-formed aircraft parts are formed by being forced over a form block by rubber pressure in a con-

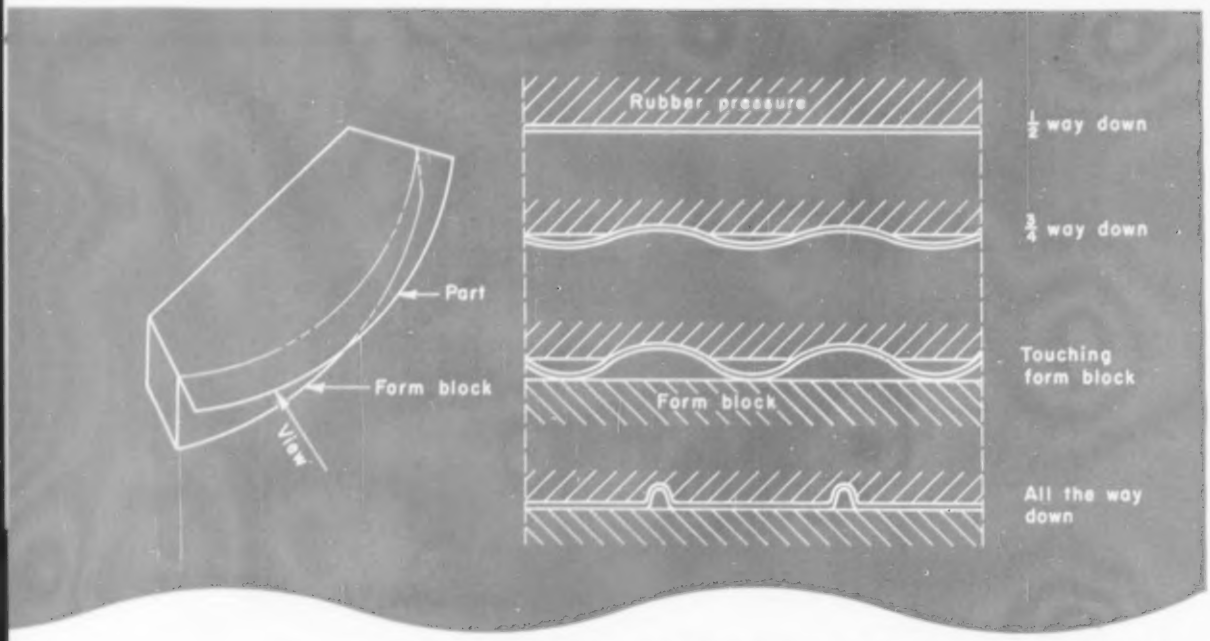


Fig. 1. Buckling of a shrink flange. In this case, compressive stresses cause the flange to buckle into a sine wave before it comes in contact with the form block. The sine waves are compressed laterally against the form block.

Nomenclature

D = the plate constant in the plate buckling equation
E = Young's modulus
E/S_{cy} = shrink flange form index
E/S_{ty} = stretch flange form index
$1/S_{cy}$ = shrink flange form index
$1/S_{ty}$ = stretch flange form index
G = a numerical constant
H = plate width
h = flange width
k = numerical factor in plate buckling equation, depending on length and width of plate and edge conditions
L = plate length
R = contour radius
R_A = reduction in area
S_{cr} = critical compressive buckling stress
S_{cy} = compressive yield stress
S_{ty} = tensile yield stress
t = material thickness
ϵ = true natural strain
μ = Poisson's ratio

ventional press or by being wrapped around a form block on a stretch press. Regardless of the type of forming, specific part geometries usually fail in the same way. Curved flanges, for instance, fail primarily from plate buckling whether they are formed by shrinking or by stretching.

RUBBER-FORMED PARTS: When flanges are shrink-formed in a rubber press, the longitudinal fibers in the flange are all compressed to a shorter length. Compressive hoop stresses develop in the fibers, resulting in either a plastic flow of the fibers, or an elastic or elastoplastic buckling of the flange when a critical value is reached during forming. The former gives a smooth flange while the latter results in wrinkles.

All of the buckling limitations, whether the flange is being compressed or elongated, depend upon the elongation ratio h/R, the buckling ratio h/t and the material properties, where h is the flange width, R is the contour radius and t is the thickness of the material. Compressive stresses in a shrink flange will increase with increasing values of h/R and flange stability decreases with increasing values of h/t. Nomenclature for all

symbols used in the article is contained in the accompanying table.

Before considering the effect of material properties on formability, the purely mechanical aspects of buckling and other phenomena which lead to part failure will be discussed. The mechanics of the wrinkling process in shrink flanges are illustrated in *Fig.* 1. As the flange is being pressed down by the rubber, a point is reached where the compressive stresses in the flange reach a critical value and the flange buckles into a sine wave. Length of the half-wave is slightly less than the flange width.

Plate buckling is also the major limitation to formability in rubber-formed stretch flanges. The governing factors are again h/R, h/t and the properties of the material. In this case, however, the compressive stresses causing buckling result from residual stresses left in the part upon release of the rubber pressure, *Fig.* 2. Buckling of stretch flanges is entirely the result of elastic stresses, while buckling of shrink flanges is the result of both elastic and elastoplastic stresses. The waves retain the shape of a sine wave because they are not compressed laterally as is the case with shrink flanges. Residual stresses in stretch flanges increase with increasing values of h/R and stability decreases with increasing values of h/t.

Other types of failure in stretch flanges are shear buckling and splitting of the flange. Shear buckling occurs only on free ends and then only with large h/R values, so it is rarely observed on actual parts. Splitting results from excessive stretching of the fibers in a flange. As the flange is formed, all fibers stretch. The outermost fibers in the flange are extended more than the inner fibers and when the true natural strain limit of the material is approached, the flange will split. There are always minute cracks in the edge of the flange and, because of the notch sensitivity of materials, the true natural strain limit is never quite reached before splitting occurs.

Insufficient rubber pressure is another cause of unsatisfactory flanges. The condition known as "minimum flange" is a consequence of the rubber acting over too small an area. Compressive or tensile flow cannot be achieved and the result is that the flange is not forced all the way to the form block. A second condition, called "hump", *Fig.* 3, results when there is not enough pressure to overcome tensile stresses in the fibers near the bend and the bending moment of the bend itself. An excessive amount of hump occurs only for small h/t and large h/R values so these limits are nearly coincident with the minimum flange limits.

Residual bending moments left in flanges cause the "crown" type of distortion, *Fig.* 4. With thin materials, "oilcans" may be observed in the web. They result from residual compressive stresses in the web itself. Neither of these types of distortion leads to rejection of a part in themselves. They can be relieved by hand-working or by using stress-relief fixtures.

Springback is likewise observed in varying degrees on all parts. It will result in a smaller part-contour radius than the form block for stretch flanges, while the opposite is true for shrink flanges. The amount of springback is dependent upon h/R, the material and the web stiffness. Springback is controlled by die development, hand-working and stress-relief fixtures.

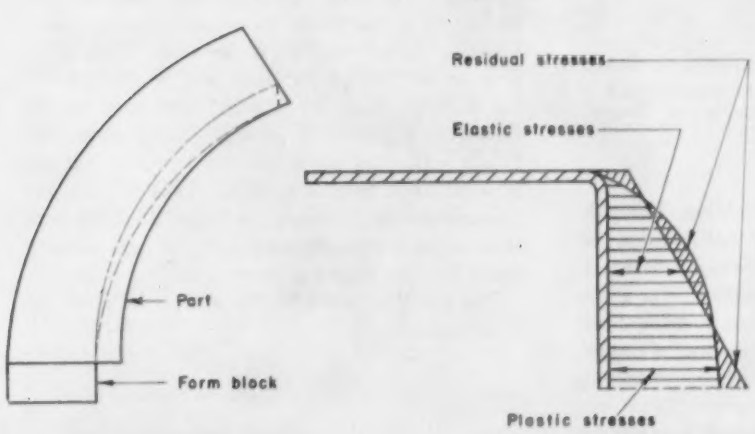


Fig. 2. Residual stresses left in flange after forming cause buckling of rubber-formed stretch flanges.

STRETCH-PRESS-FORMED PARTS: Plate buckling, as already mentioned, is the primary cause of failure of all contoured flanges. Flanges formed on a stretch press exhibit the same type of sine waves as flanges of rubber-formed parts when formability limits are exceeded, *Fig. 5.*

Twist buckling, another form of distortion associated with stretch-press formed parts, cannot be considered a failure. Like crown and oilcam it is evident on all parts and can be removed by hand-working or stress-relief fixtures.

The second type of failure in stretch-formed parts results in wrinkling and splitting of the part. As h/R is increased, it becomes more difficult to move the neutral axis toward the compression side, so a portion of the concave side of the flange is in compression. When these compressive stresses reach a critical value, which is determined by h/t, the flange buckles into a sine wave, *Fig. 6.* If the part is adequately constrained, the dies spread. With a further wrap, the sine waves are flattened into square waves. Thus, because of the lateral forces and the reduction of the h/t to h'/t, buckling does not occur as readily as in rubber-formed shrink flanges.

If the neutral axis can be pulled to the inner edge of the flange there will be no compressive stresses and, consequently, no wrinkling. This cannot be accomplished with a large h/R because the required movement of the neutral axis would break the part, so wrinkling is inevitable. When the part is pulled so hard that the true natural strain is exceeded, the part breaks. Thus, above a certain h/R, depending on the material, either wrinkling, breaking or both will occur.

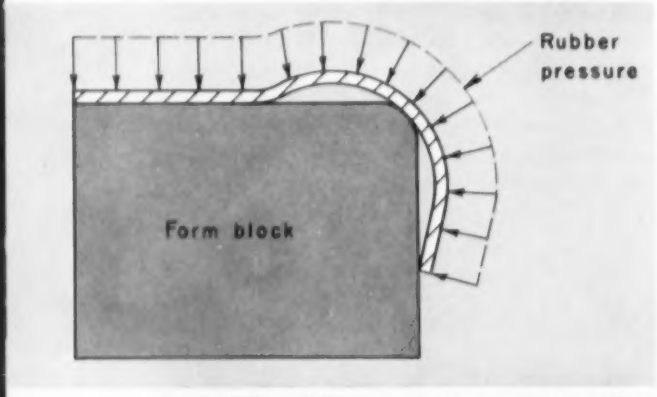


Fig. 3. When rubber pressure is not great enough to overcome tensile stresses near the bend, "hump" occurs.

A broken part can be considered beyond the forming limits only if it has some wrinkles. If no wrinkles are evident, the part has simply been pulled too hard. Conversely, a wrinkled part which is not broken is not necessarily beyond the forming limits since the wrinkles might be removed by pulling it harder.

The last major type of distortion in contour-stretch-formed parts is springback. The part will always spring back to a larger contour radius than the die. As in the case of rubber formed parts, springback is not considered to be a failure and it can be eliminated by ordinary methods of hand-working, stress-relief fixtures or overforming.

To summarize, all types of distortions occuring in curved flanges may be classified as to whether they are beyond or within forming limits. Evidence that formability limits have been exceeded is furnished by:

1. Wrinkles in rubber-formed flanges
2. Waves (plate buckling), shear buckling and splitting in rubber-formed stretch flanges
3. "Minimum flange" and "hump" in rubber-formed parts
4. Waves (plate buckling) in contour-stretch-formed parts
5. Broken flanges accompanied by wrinkling in contour-stretch-formed parts.

Other types of distortion are considered to be within forming limits. These are:

1. Crown and oilcan in the web of rubber-formed parts
2. Twist buckling (section rotation) in contour-stretch-formed parts
3. Wrinkling without breaking or breaking without wrinkling in contour-stretch-formed parts
4. Springback in any type of contour forming.

The Plate Buckling Equation: It is apparent from the foregoing discussion that plate buckling is the principal limitation to formability in contour forming. The other types of distortion can be controlled or corrected. In contour forming, plate buckling occurs on flanges if at all. This is so because the critical buckling load is much lower for a flange than for a web. The web can be classed as a plate with all edges freely supported. Freely supported edges are free to rotate but are constrained to remain straight. Thus they cannot take any bending moment. A flange is a plate with three edges freely supported and one edge entirely free. The free edge can bow as well as rotate.

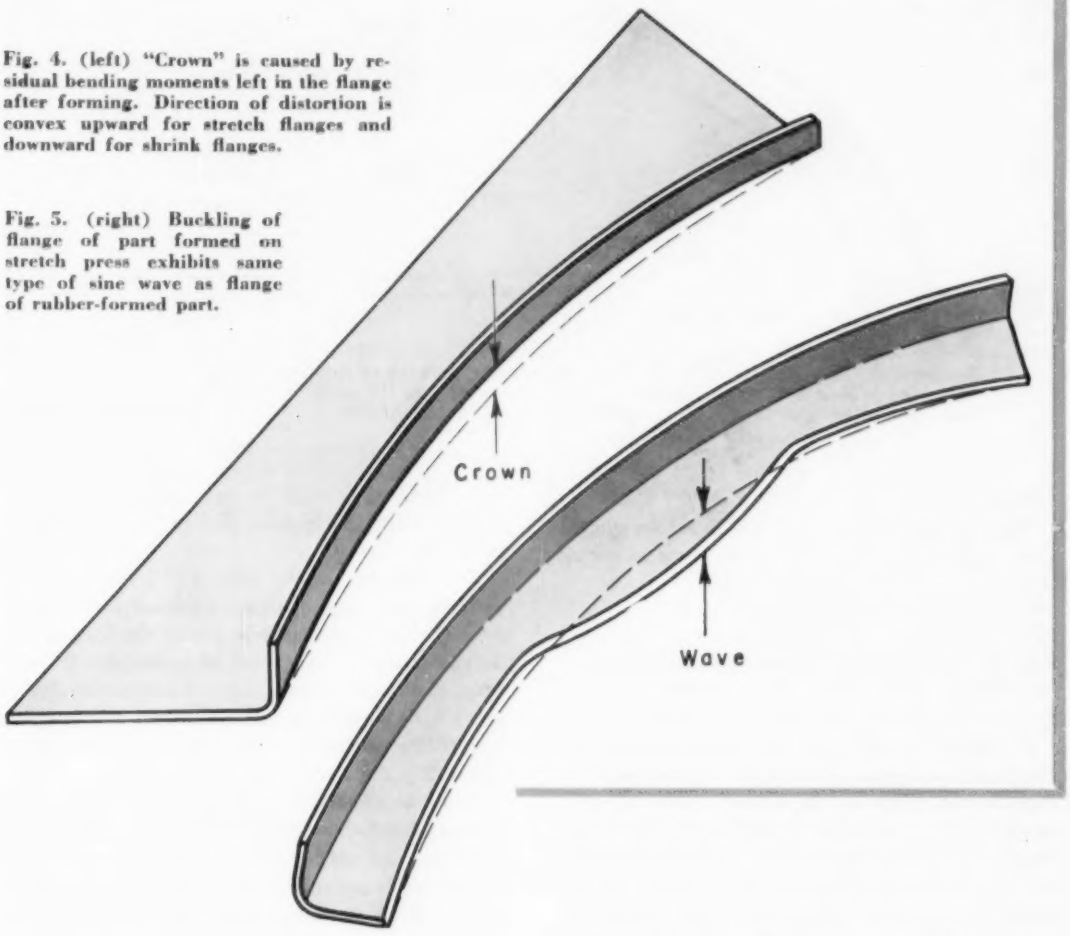
The buckling equation for a plate is given by Timoshenko as:

$$S_{cR} = k \frac{\pi^2 D}{H^2 t}$$

where S_{cR} is the critical compressive-buckling stress, k is a numerical factor depending on the length L and the width H of the plate, t is the

Fig. 4. (left) "Crown" is caused by residual bending moments left in the flange after forming. Direction of distortion is convex upward for stretch flanges and downward for shrink flanges.

Fig. 5. (right) Buckling of flange of part formed on stretch press exhibits same type of sine wave as flange of rubber-formed part.



thickness of the material and D is the plate constant as defined by:

$$D = \frac{Et^3}{12\,(1-\mu^2)}$$

where E is Young's modulus and μ is Poison's ratio. The numerical factor k depends not only upon L and H but also on the edge conditions of the plate. For a web, $k = 4$ when L/H is greater than 1. When L/H is less than 1, k increases rapidly toward infinity. For a flange with one free edge, k is given by the relation.

$$k = 0.456 + (h/L)^2$$

The $(h/L)^2$ term diminishes toward zero for a long-angle section so that when L/h is greater than 20, $k = 0.456$.

Substituting the value of D into the buckling equation:

$$S_{cR} = \frac{k\,\pi^2}{h^2\,t}\left[\frac{E\,t^3}{12\,(1-\mu^2)}\right] = \frac{k\,\pi^2\,E\,t^2}{12\,(1-\mu^2)\,h^2}$$

Letting G, a numerical constant, equal:

$$G = \frac{\pi^2\,E}{12\,(1-\mu^2)}$$

then

$$S_{cR} = \frac{k\,G}{(h/t)^2}$$

and it is found that the critical stress is inversely proportional to $(h/t)^2$.
Taking the log of both sides gives:

$$\log S_{cR} = \log k\,G - 2\log\,(h/t)$$

This is a hyperbola, which, when plotted on log-log graph paper, will give a straight line with a slope of -2 and an intercept on the S_{cR} axis of log kG when $h/t = 1$.

It is desirable to fit this equation to the buckling of angle sections in contour forming; however, the applied stress S_{cR}—the compressive hoop stress in shrink flanges and the residual compressive stresses in stretch flanges—is unknown. Both of these stresses depend upon the elongation ratio h/R and a formability index factor which will be

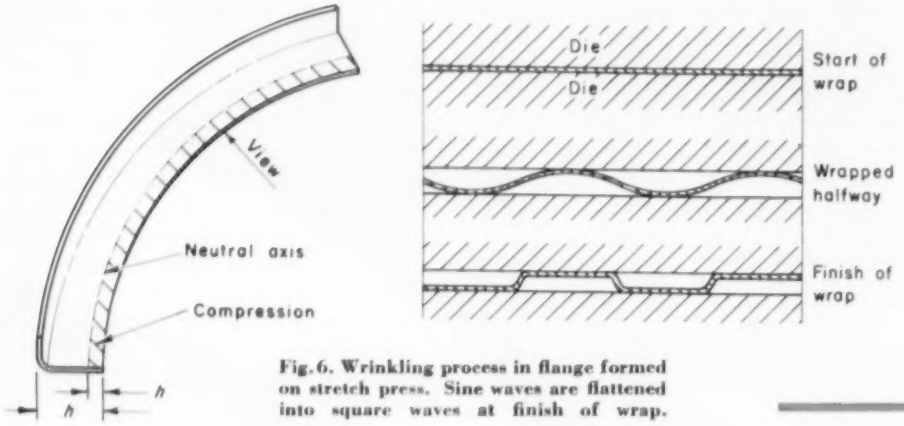


Fig. 6. Wrinkling process in flange formed on stretch press. Sine waves are flattened into square waves at finish of wrap.

discussed shortly.

Thus, it would seem that h/R could be plotted empirically against h/t. This is the same as saying that S_{cR} is a definite function of h/R.

$$S_{cR} = f\,(h/R)$$

Experimental work has shown that this statement is correct.

Formability Indexes: The magnitude of the compressive stresses developed in contour forming depends not only on the h/R but also on the material. For instance, the stability of a shrink flange will depend upon Young's modulus E, while the build-up of compressive hoop stress will be dependent upon the compressive yield stress S_{cy}. As E diminishes, $S_{cR} = f\,(h/R)$ will decrease. As S_{cy} increases, it will become increasingly more difficult to reach compressive flow before buckling is reached.

Consequently, as the ratio E/S_{cy} decreases, so will the h/R causing flange buckling for a given h/t. The ratio E/S_{cy} may be termed the formability index for shrink flanges of all materials. It indicates the relative formability of a material for a given h/t. When E/S_{cy} is small, there will be poor formability, while a large E/S_{cy} indicates good formability.

A similar index may be obtained for rubber-formed stretch-flanged parts and for parts formed in a contour-stretch press. In these two cases, the critical stress will not develop from a direct compressive hoop stress but from residual stresses left in the part, as previously mentioned. Flange sta-

formability indexes

Material Characteristics	Symbol	3S-0	24S-0	52S-0	61S-0	75S-0
Modulus of Elasticity (x 10^6)	E	10.5	10.5	10.5	10.5	10.5
Tensile yield stress (x 10^3)	S_{ty}	6	11	12	8	15
Compressive yield stress (x 10^3)	S_{cy}	6	11	12	8	14
Conventional strain (percent)	e	40	22	30	30	16
Reduction in area (percent)	R_A	71	43	68	75	40
True natural strain (percent)	ϵ	124	56	114	138	51
Stretch flange form index (x 10^3)	E/S_{ty}	17.5	9.55	8.75	13.1	7.00
Shrink flange form index (x 10^3)	E/S_{cy}	17.5	9.55	8.75	13.1	7.50
Shrink flange form index (x 10^3)	$1/S_{cy}$	16.7	9.10	8.33	12.5	7.15
Stretch flange form index	$1/S_{ty}$	16.7	9.10	8.33	12.5	6.66

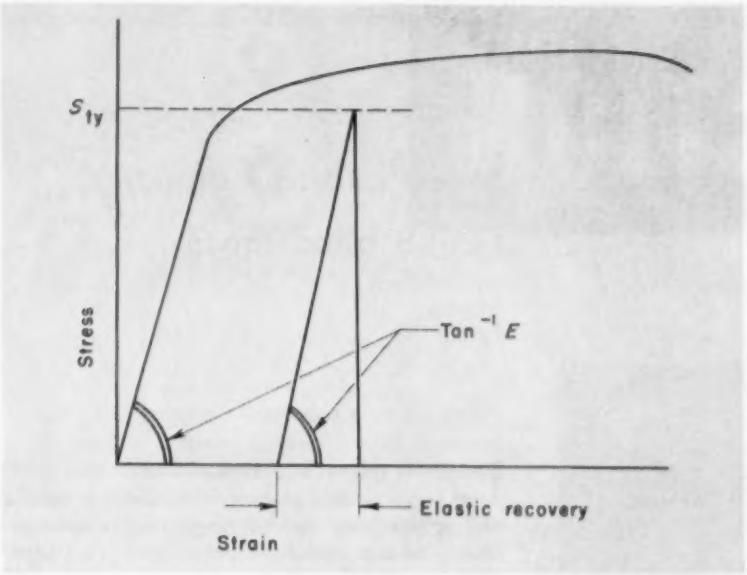


Fig. 7. Typical stress-strain curve. Residual stresses increase when E is decreased and when S_{ty} is increased.

bility will again depend on E while the magnitude of the residual stresses will be determined by both E and the tensile yield stress S_{ty}. As shown in *Fig.* 7, the residual stresses will increase when E is decreased and when S_{ty} is increased.

Therefore, as the ratio E/S_{ty} decreases, $S_{cR} = f(h/R)$ will decrease for a given h/t. Materials with a low index E/S_{ty} will exhibit poor formability, while a large index will indicate good formability.

An alternate index is possible for shrink flanges. With small h/t values, the compressive yield point is reached before buckling occurs. As the fibers proceed into the plastic region, a stress is finally reached where plastic buckling results. This stress has been shown empirically to depend upon the inverse of the compressive stress for a material, $1/S_{cy}$, indicating the materials with a high compressive yield will have poor formability in the elastoplastic region.

Formability indexes and other pertinent properties of a number of materials used in aircraft design are given in the accompanying table. These indexes have been used in establishing formability limit curves for all of the materials listed. The curves will be published in a subsequent issue of THE TOOL ENGINEER.

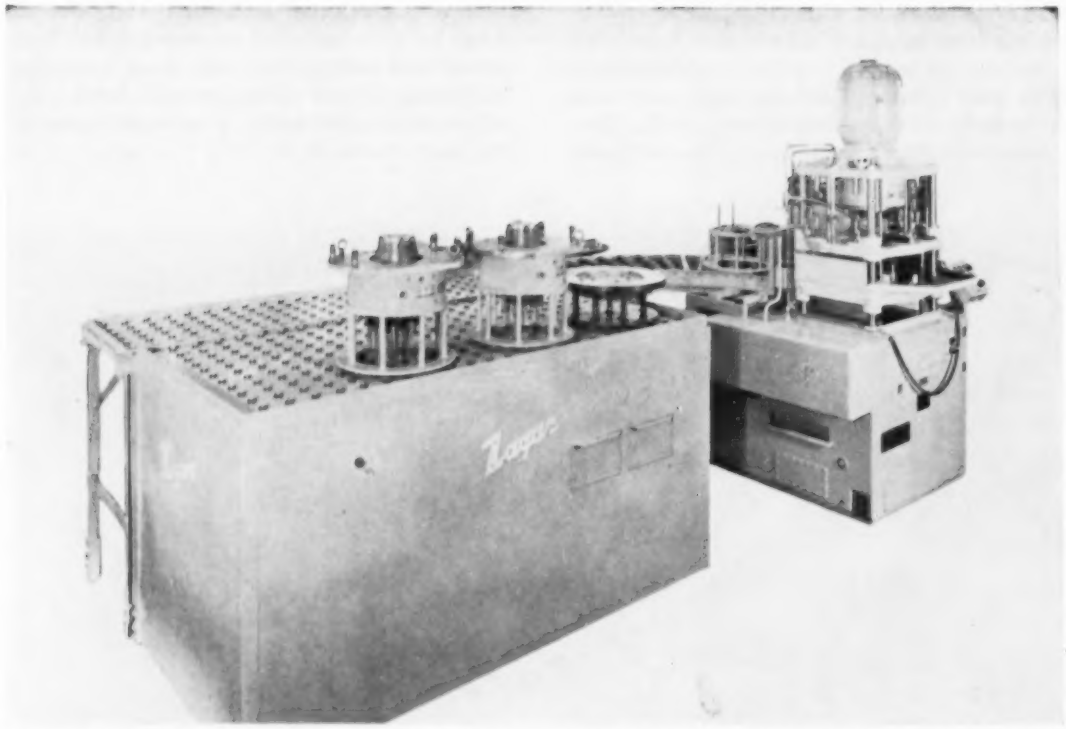
Material											
3S-½H	24S-T3	52S-½H	61S.T4	61S-T6	75S-T6	RC-70	RC-130	302(A)	302(½H)	4130(A)	1025(H.R.)
10.5	10.5	10.5	10.5	10.5	10.5	16	16	29	26	29	29
19	52	31	21	40	72	70	125	30	110	75	39
19	52	31	21	39	75	70	125	35	85	75	60
16	17	14	25	17	11	20	17	40	20	22	38
54	17	59	54	49	17	50	40	60	....	63	58
78	19	89	78	67	19	69	51	92	....	99	87
5.50	1.84	3.40	5.00	2.62	1.46	2.29	1.28	9.66	2.36	3.87	7.44
5.50	2.02	3.40	5.00	2.70	1.40	2.29	1.28	8.30	3.06	3.87	4.85
5.25	1.92	3.22	4.76	2.57	1.33	1.43	0.80	2.86	1.18	1.33	1.67
5.25	1.75	3.22	4.76	2.50	1.39	1.43	0.80	3.33	0.91	1.33	9.56

designed for

PRODUCTION

Multiple-Spindle Drill Tooling Changed Quickly

Problems of tooling storage and wasted tool-change time have been solved for multiple-spindle drilling machines by development of a ball-and-roller conveyor and ball-topped table. The Zagar table serves as storage for 24-inch hydraulic drill heads. Each head is held in an individual loading basket. The empty basket for the head in use is stored on the roller conveyor, convenient for use when the current production run is completed.

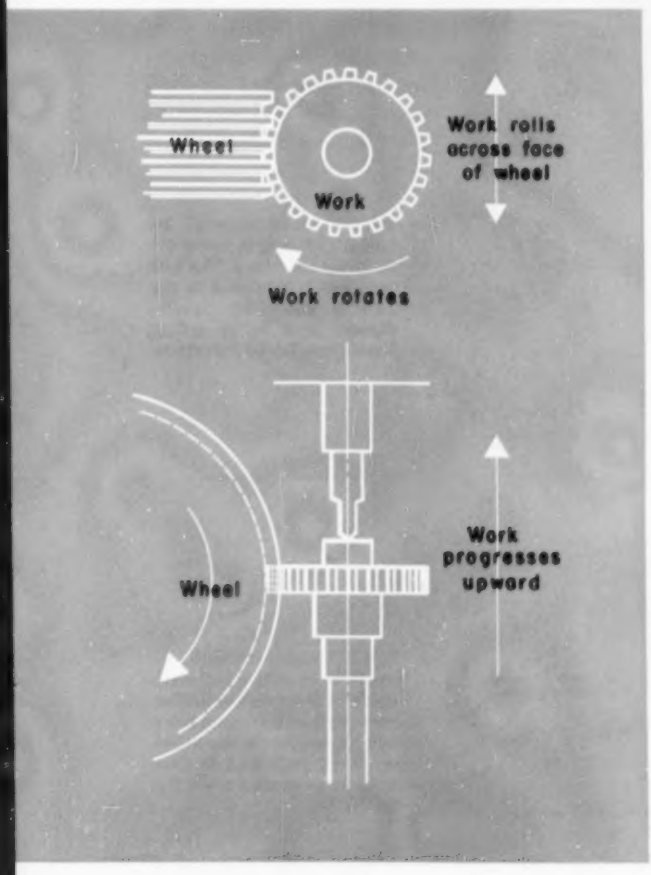


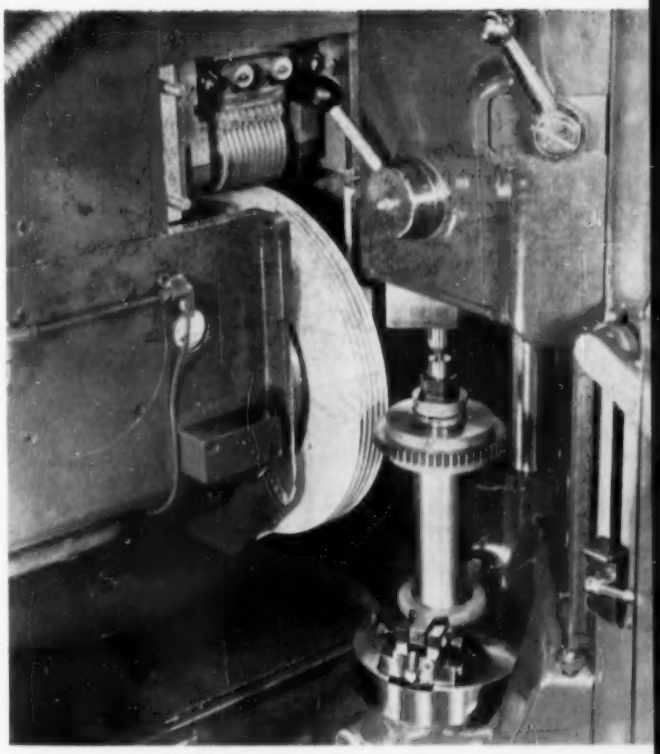
A HEAD is changed by dropping it onto its basket, removing the bushing plate and locators, and rolling it to the storage table. Bushing and locators for the next head are positioned in the drilling unit. The head for the next job is rolled under the drilling unit and raised into position.

Machine Grinds Precision Gears From Solid Blanks

Since larger volumes of precision gears are needed in modern machine tools and military equipment, a machine has been developed to grind gears after the blanks have been hardened. This procedure assures accuracy because heat-treating distortion is avoided. Several blanks can be ground at once on this machine developed by The Sheffield Corp.

Parts having pitches between 8 and finer can be ground from the solid, but the coarser pitches should be preformed before grinding in order to save time. For some classes of work, this machine yields three times as much production as is possible with other processes.





ACCURACY of the workpiece depends on the accuracy of the helically formed wheel. The basic rack form is produced in the wheel by crush-roll dressing. The wheel is then dressed by a double-diamond dresser that follows the entire length of the form. The wheel is then redressed with the crush roll for free cutting action, tip relief and fillet radii.

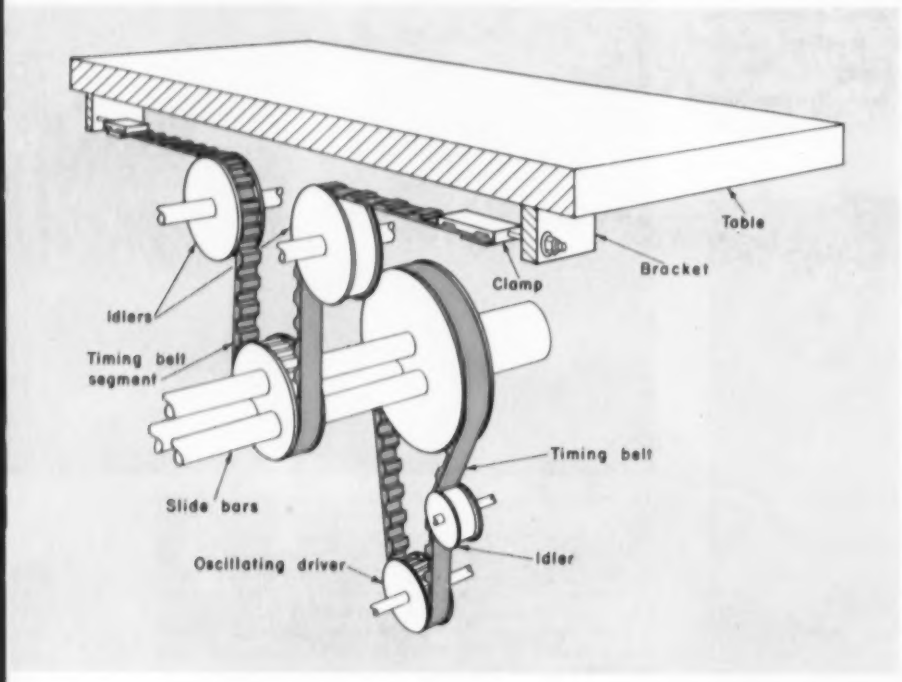
Both the crushing roll and the diamond dresser are actuated by the same hydraulic unit and cam mechanism. Infeed for either dressing step can be automatic or manual. The crush-roll cover has been removed and the twisted wire tufts that keep this roll clean are visible.

GEAR BLANK is mounted on vertical live and dead centers. Operation is similar to hobbing in that the work rotates continuously at a rate synchronized with that of the grinding wheel. Simultaneously, the workpiece moves upward and rolls across the face of the helical rack form on the wheel Gears, helical or spur, of different diameters but having the same circular or diametral pitch can be ground without redressing the wheel.

Cogged Belts Prevent Grinding Marks

Because cogged timing belts bend smoothly around curves, a segment of such a belt is used in the table drive of a surface grinder so the wheel will move continuously and not leave "chain chord" marks on the work. This is just one of the interesting features of the Model 824 surface grinder developed by Reid Brothers Co., Inc. Table traverse for this model is through an electric clutch transmission. A variable-speed d-c motor alternately drives two shafts; at the end of each stroke, a reversing switch de-energizes one clutch and energizes the other. Power is transmitted to the table through the timing belts.

In addition to having powered traverse, cross feed and elevation, this surface grinder features handwheels that are interlocked with the power drives so they cannot rotate during powered operation. When the handwheels are pulled toward the operator, a precision limit switch completes the power operation circuit. Another interesting feature of this grinder is the two stainless-steel Neg'ator (constant-force) springs used to provide dust protection for the vertical way surfaces. One end of each of the springs is fastened to the wheelhead. The other ends are free to roll and unroll at the top and bottom of the column. Width of these springs is sufficient to cover the column opening.



TIMING BELTS transmit intermittent forces from the drive to the table. The belt segment is attached to the table ends by special clamps and bolts acting through spherical washers.

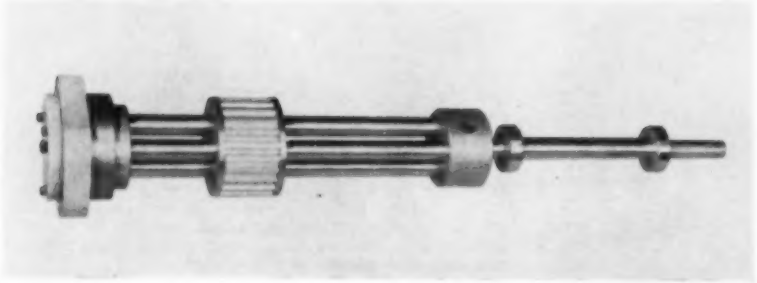
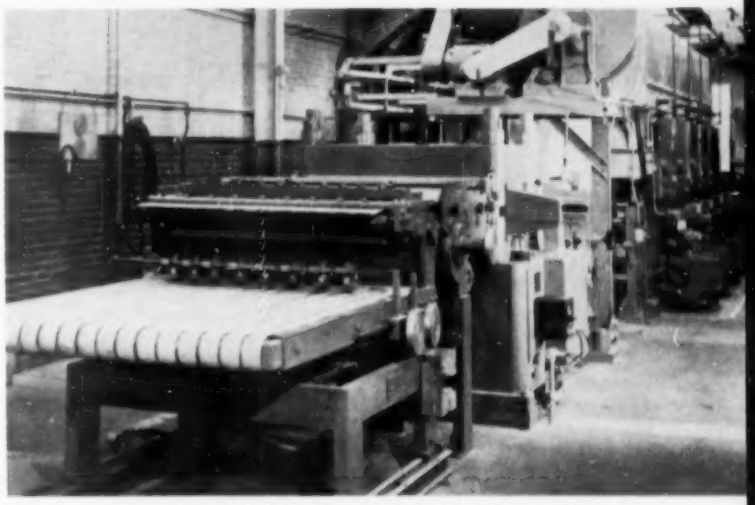


TABLE RECIPROCATION is possible in any cross-feed location because the pulley over which the segmented belt operates is mounted on three rods and is free to slide crosswise with the table.

Direct-Current Drives Replace Lineshaft in Box-Making Machine

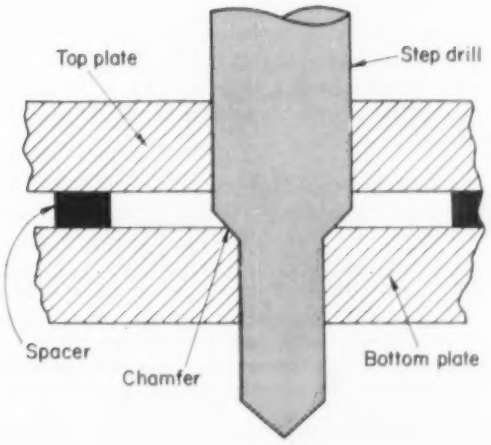
A drive system powered by individual direct-current motors, instead of the traditional lineshaft, has been adopted for use on a five-color rotogravure printing press. The press is connected to a reciprocating cutter and creaser. The new system, developed by General Electric for the Ohio Boxboard Co., represents one of the first successful attempts to sectionalize such an operation without a lineshaft.

The drive is composed of three major sections: unwind; press and drier; and cutting, creasing and stripping. The lead machine consists of the press and drier section powered by three direct-current motors of 5, 10 and 50 hp for the feed roll, pull roll and main press drives. The three motors are driven from a common generator. Automatic tension control is provided by means of a tensiometer, between the feed roll and press, and between the press and pull roll.



A CONTINUOUS web is fed from the unwind stand into a five-color press unit through a free loop, the length of which is automatically controlled. After five registered colors are printed on the web, it is fed through another free loop into a blanking machine. The blanking machine cuts out the finished boxes, creases each for easy folding and strips off the scrap.

Chamfered Step Drill Solves Unusual Problem



With 2400 identically spaced holes to be drilled in each of two 2 by 4-foot plates, 0.550 inch thick, special methods had to be devised by Westinghouse Electric engineers. Holes in one plate are smaller than those in the other plate but must align accurately. Much time is saved and positive alignment is assured by using a step drill and drilling both plates at the same time.

The step drill, with 0.640 and 0.328-inch diameters, has a standard drill point on the small diameter and a chamfer ground on the cutting edge of the large diameter. One operation produces a hole in each plate and a chamber on the top side of the bottom plate. The other chamfers are achieved by three subsequent operations.

how to plan for automatic assembly

By George H. Kendall, Sr.

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Kenhos Corp.
Norwalk, Conn.

When is it feasible to automate manual operations? What are the steps in planning a successful automatic installation? What are the costs involved? The author's long experience as a consulting engineer and as a designer and builder of special machines makes it possible for him to give some definite answers to these questions. This material was first presented at the 1956 Pennsylvania State University automation seminar.

SUCCESSFUL AUTOMATIC MACHINES are the tangible result of long and careful planning and cooperative effort on the part of management, tool engineers, product designers, electrical engineers and trouble shooters. Irrespective of the nature of the operations performed, the steps in planning such machines, *Fig.* 1, and seeing them through to their ultimate installation and successful operation in a plant are basically the same.

Initial Survey: When the replacement of manual assembly operations by an automatic machine is under consideration, the first step in planning is for management to clearly define the degree of automaticity desired, and what goals, in terms of initial costs, production volumes and manufacturing cost reductions, are to be achieved. Establishing these objectives is a necessary prerequisite to sound and realistic engineering planning. Preparation of an initial survey, covering the design of the product to be assembled and the types of operations required to meet production cost and volume objectives is the next essential step in planning. The information compiled in the survey is necessarily tentative at this time. Many changes will be made as the program progresses and planning and machine design become increasingly more definite.

The initial survey should, however, provide an accurate answer as to whether or not the product can be assembled by simple, direct feeding motions or whether compound motions are required. Generally speaking, the cost of mechanisms to produce compound motions is higher than can be justified for automatic assembly tooling. In some cases, redesign of the product will eliminate the need for compound motions. This possibility should be thoroughly explored during the initial survey. Another important point which should be covered in the initial survey is the degree of automaticity to be applied.

The equipment selected may be fully automatic, or semiautomatic in operation. The latter, with some manual feeding or positioning of parts, may be the most practicable solution to specific assembly problems.

Detailed Planning: Assuming that initial surveys show that automatic or semiautomatic assembly is feasible for a given product, detailed planning can be started. Steps in detailed planning include:

1. Analyzing the product to determine which assembly operations can be most profitably automated.
2. Determining the sequence of assembly operations.
3. Selecting the assembly method—automatic or semiautomatic.
4. Selecting tooling.

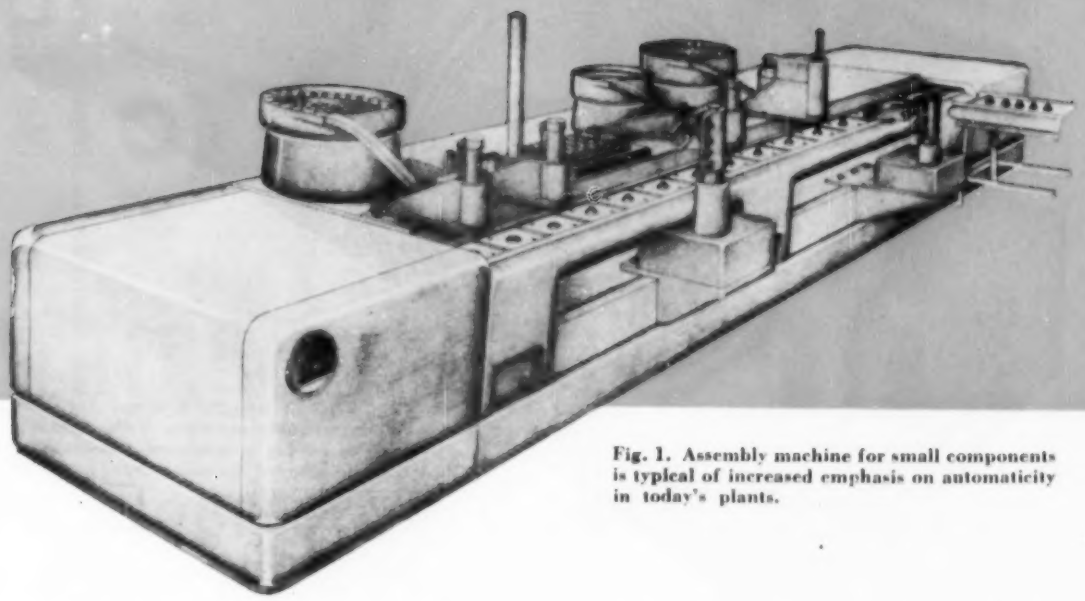


Fig. 1. Assembly machine for small components is typical of increased emphasis on automaticity in today's plants.

5. Deciding on the best method of machine control.
6. Devising means of overcoming possible machine obsolescence caused by product design changes.

Two factors—volume requirements and complexity of the product—determine the extent to which automatic assembly methods are used. If production requirements are high and a product can be readily assembled automatically, fully automatic assembly methods are an obvious choice. If, on the other hand, production requirements are high but the product is complex, a semiautomatic production method, with some manual operations, is preferred. Semiautomatic methods are also selected when production runs are so short that the cost of tooling for fully automatic assembly cannot be written off during the life of the product.

Determining the best type of tooling for specific applications is a task calling for great skill on the part of the tool engineer and if his analysis shows that the cost of tooling can be reduced by making changes in product design, such changes should be given full consideration. Cooperation and compromise between the tool engineer and product designer are essential if tooling costs are to be kept low and the final machine is to perform in a satisfactory manner.

When it is planned to perform a number of assembly operations successively, in-line transfer type machines are often used. Experience has shown that the following design considerations are important to successful operation of machines of this type:

1. Fully automatic electrical control of the machines and all tooling attachments is essential. There should be no way for an operator to change the preset timing of the machine cycle.
2. The sole function of the transfer mechanism should be to move pallets holding workpieces from station to station.
3. An adjustable speed control for the work cycle time should be provided. This makes it possible to select the best speed for assembly.
4. Transfers of workpieces from station to station should be made at as fast a rate as possible, since transfer time is actually nonproductive time. Dwell work time—the time a workpiece is actually being assembled—should be independent of transfer time.
5. All assembly stations, as well as the transfer mechanism, should be triggered from the master control panel.
6. Individual asembly stations should have their own control panels which cycle automatically in response to the signal from the master control panel.
7. A feedback arrangement should be used, so that individual assembly stations send an "all-clear" signal to the master control panel when assembly operations have been completed. On receiving a signal from all stations, the master control panel can then signal for the start of the transfer.
8. To facilitate location of trouble areas by the operator, each station should be equipped with a light which is turned on when the station is in operation and goes off when the station is clear.

In addition to the considerations listed, the possibility of product design changes which would obsolete the machine should be carefully considered. Many large plants are today faced with the problem of providing virtually infinite equipment flexibility to meet radically changing product design requirements. If special machinery, suitable for only one product design, is used, the cost of obsolescence can be a serious problem. This is particularly true in the case of large automatic assembly machines, which represent sizable capital investments. In the case of transfer type machines, one solution to the obsolescence problem is to use a basic transfer machine, *Fig.* 2, which can be adapted for the

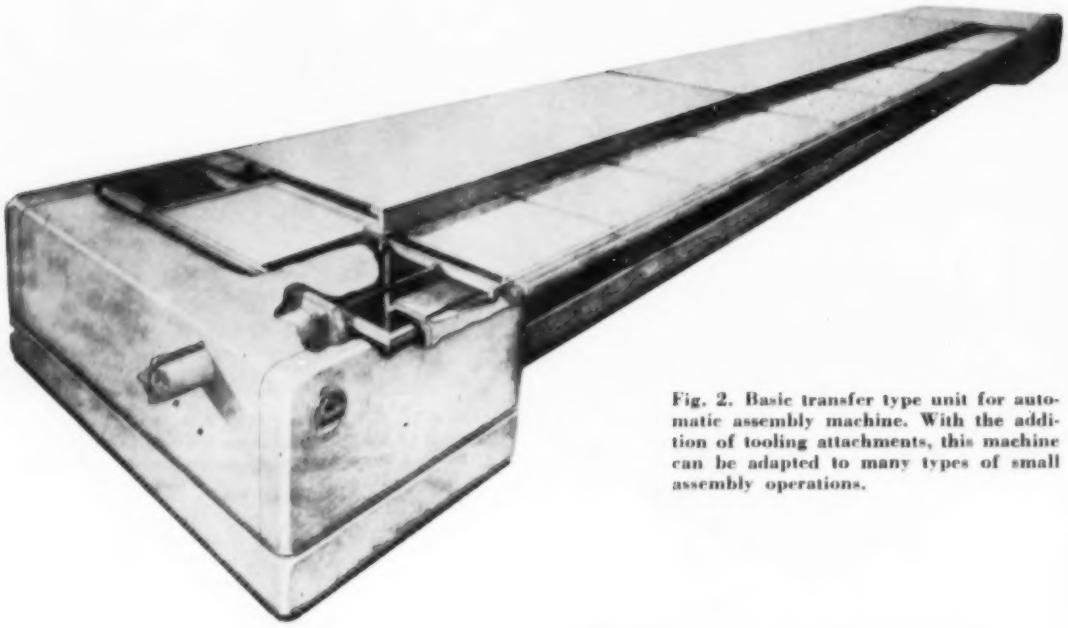


Fig. 2. Basic transfer type unit for automatic assembly machine. With the addition of tooling attachments, this machine can be adapted to many types of small assembly operations.

assembly of a variety of product designs by use of readily detachable heads.

Costs: After initial planning has been completed, the next step is to obtain quotations from machine builders to establish an approximate cost for the machine. Quotations obtained at this time are usually approximate, since it is impossible for a machine builder to quote firm prices unless engineering drawings and a bill of materials are available. However, approximate estimates are adequate for planning purposes.

As a general rule, it can be safely estimated that the cost of fully automatizing one hand operation will require an investment of from one to one and one-half times the yearly wages paid for that operation. This figure has proved to be a good planning guide when applied to the assembly of hardware, electrical components, bearings, and similar small products, and represents an average which has been developed from data on some 3000 jobs. In terms of dollars and cents, the cost of one automatic station will average between $4500 and $6500. There are some cases where the cost is slightly less and a few cases where costs have been considerably higher owing to complicated assembly requirements, but they are in the minority and do not affect the validity of these figures. In planning for a multiple station automatic transfer machine, the investment figures indicated are multiplied to obtain a quick estimate of total tooling costs for any one product. The resulting figure will be found to be as close as any two estimates subsequently received from machine builders.

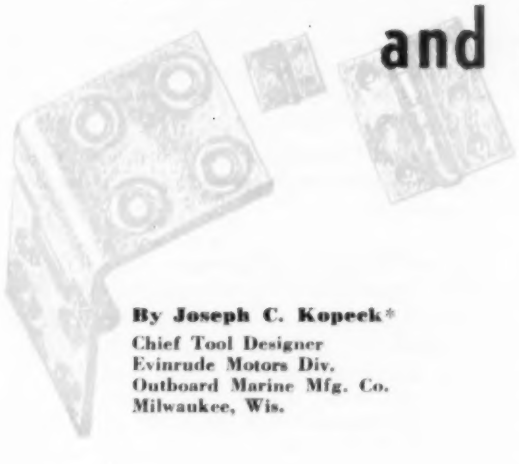
Installation and Tryout: As the automatic assembly machine passes through detailed design, building, installation and tryout, it is important that the same group of engineers follow all phases of the job. No two engineers can be counted on to solve machine and tool design problems in identical ways, and changing engineers during the program can lead to an excessive number of costly changes in tooling.

No automatic machine should be scheduled for production until it is fully "debugged" and has pased acceptance tests. From one to three months is commonly required to adjust such machines to the point where they are capable of fully satisfactory performance. During this period, management should be patient and avoid any tendency to place pressure on the individuals responsible for detail work. Causing these men to become upset at such a time can place the success of the entire program in jeopardy.

An important factor in the satisfactory operation of a new machine is the ability of operators and maintenance men to keep the machine in production. Even with machines of sound design, thorough operator training prior to the time the machine is placed on the production floor, plus adequate incentives, are essential to keep down time to a minimum. Many excellent machines have been scrapped because management forgot these human factors. In the final analysis, the more automatic the machine, the greater the need for operators and maintenance men who take a real interest and personal pride in keeping it in operation.

hinge production

progressive dies cut stamping and assembly costs



By Joseph C. Kopeck*
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Several basic methods of hinge manufacture are in common use, illustrating that there are always a number of possible and effective ways of solving a given processing problem. The author, who has many years of tool engineering experience, discusses alternate methods and defines the advantages and limitations of each method.

FROM A TOOLING standpoint, sheet metal hinges can be placed in one of three major groups, according to method of production. Most hinge manufacturers employ one or more of the basic methods, with minor variations to suit specific part designs.

As in any other field of manufacture, tool engineers are confronted with problems of minimizing material waste and devising methods which lend themselves to economical production. No "perfect" hinge manufacturing method has yet been found. For instance, the method which results in least material waste also requires the largest amount of direct labor.

First Method—Individual Die Operations: The best material layout is that used in the method shown in *Fig.* 1. Both wings of the hinge are blanked from a single piece of stock. One disadvantage of this method is that, because of the way the material shears in the die, the two wings will not mesh. Additional interference results when the loop of the hinge is formed. To obtain uniform clearances and good bearing surfaces it is necessary to remove the excess metal and smooth the edges of the loops.

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This is accomplished by broaching.

The operations involved in making hinges with the first method are:

1. Shear stock to length
2. Shear stock to width
3. Blank the wings
4. Sort the wings
5. Curl the loops
6. Broach end of loops
7. Ream both wings
8. Assemble with pin
9. Pierce holes
10. Countersink holes

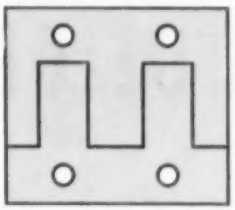
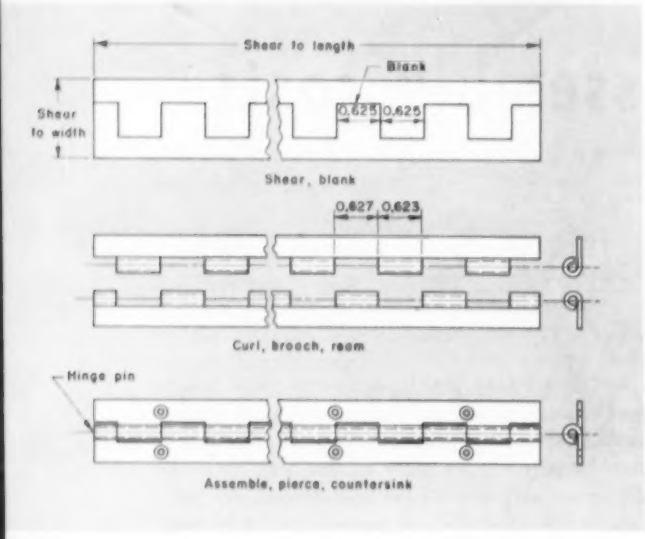


Fig. 1. (right) Layout for blanking hinges for economy of material. Stock waste is minimized, but rough edge left by blanking must be sized and smoothed.



This method, *Fig.* 2, is used for hinges from 12 to 72 inches long. Because of the large amount of handling, production costs are high. Product quality is excellent, however, and, as noted, the material in the strip is fully utilized. No other method of hinge manufacture gives both these advantages.

Stock for long hinges is generally sheared from sheet stock. For hinges up to 12 inches long, operations 3, 4, 9 and 10 can be combined by using coil stock which is slit to width. Piercing, countersinking and separating operations are performed in a progressive die, *Fig.* 3. The countersinking station, not shown, can be added just before the cutoff. Brass hinges are usually swage-countersunk by driving a punch, which has been ground to the desired shape, into the hole. Emboss-countersinking is employed for steel hinges.

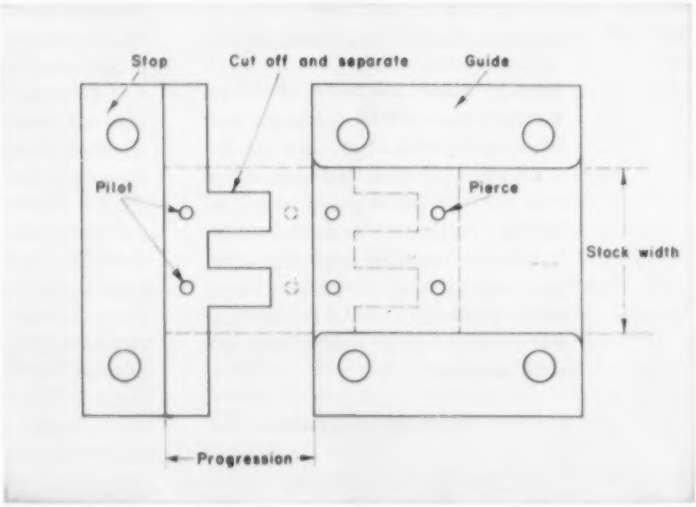
Some manufacturers find that it is profitable to combine the curling, broaching and countersinking operations on one machine. Special machines for reaming and assembling hinges are also in use. In machines of this type, the wire for the hinge pin is cut to the correct length and assembled to the hinge. Both ends of the pin are then spun to form heads. If an offset is desired in this type of hinge, the form is put into the wing before the hinge is assembled.

Second Method—Progressive Dies: Another common method of hinge manufacture, *Fig.* 4, is to make the two wings of a hinge separately, in progressive dies, and then assemble them with the pin. A typical sequence of operation is:

1. Notch, first curl, second curl, cutoff
2. Assemble with pin

Fig. 2. (above) Sequence of operation for materials savings method. Stock is sheared to size, then blanked. The two wings are then separated for curling, broaching and reaming operations. Piercing and countersinking are performed after assembly.

Fig. 3. (right) Progressive die for blanking hinges from coil stock, used for hinges up to 12 inches wide.



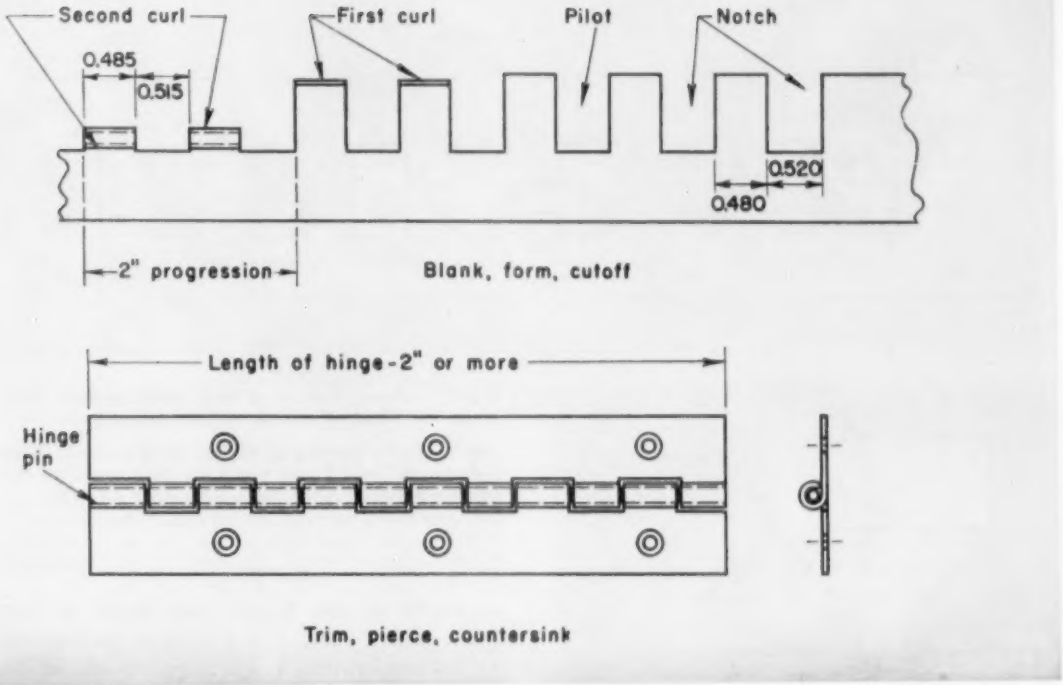


Fig. 4. Successive operations in progressive die. Each wing is blanked separately from coil stock. Wings are assembled, then pierced and countersunk.

3. Trim ends, if required
4. Pierce holes
5. Countersink holes

This method is suitable for hinges from two to 120 inches in length. If the two wings are identical they can be made in the same progressive die, and as one wing is completed it can be turned end for end and assembled with the preceding wing. If the wings are not identical, as is often the case, two dies are required.

Some progressive dies in use have six stations: pierce, pilot, notch for loops, first form, curl and cutoff. Countersinking, numbering and swaging stations can be added, as well as additional forming and notching stations, depending on the design of the hinge. Broaching is unnecessary, since the width of the loop is controlled in the notching station. Production rates are high and no handling between operations is required.

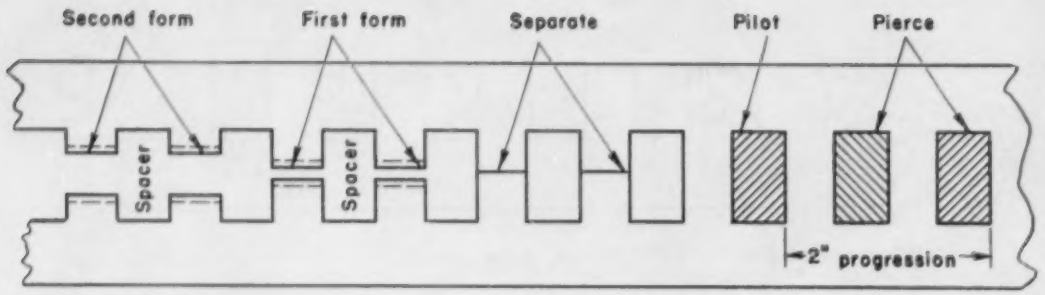
When hinges are longer than the progression of the die, the cutoff mechanism must be actuated after a certain number of press strokes or die progressions, as determined by the over-all length of the hinge. One way to actuate the cutoff is to place an electric switch at a distance from the cutoff blade equal to the length of the hinge. As the completed wing leaves the die it will strike the switch, which then actuates the cutoff blade at the next stroke of the press. After the wing is cut off it falls into a container or rack.

This method of cutoff can be used only when the total length of the wing is equally divisible by the length of the die progression. Otherwise, the end of the wing must be cut off to secure the proper length, and a large amount of material will be wasted.

Another cutoff method uses a counter attached to the crankshaft of the press. The counter is preset to actuate an air cylinder that moves the cutoff blade into position after a predetermined number of crankshaft revolutions or press strokes. Again, this method can be used only when the wing length is equally divisible by the die progression.

Third Method—Full Automation: In a third method of manufacturing hinges, blanking, forming, piercing, countersinking, and assembly operations are combined in one double die, consisting of separate front and rear sections. No further operations are required, except for special hinge designs.

The progressive dies used in this method are designed to operate in a four-post platen type press so the working pressures are evenly distributed over all die areas. Manufacture of the hinges starts in the rear section of the die. The strip is fed into the die from right to left by means of an automatic roll feed. Layout of the strip is shown in *Fig.* 5. Two wings are made simultaneously. In the first station, rectangular holes are pierced, providing the space in which the two wings of the hinge subsequently mesh together. One of these holes is used to pilot in the second station. This is important in maintaining uniform progression through the die.



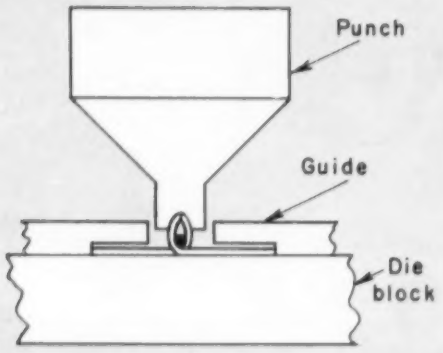


Fig. 5. (above) Layout of strip, third method. Two wings are blanked and formed simultaneously.

Fig. 6. (left) Curling operation, third method. Wire is fed onto hinge loops, which are then closed by the curling punch.

In succeeding stations the wings are separated and first and second forming operations are performed. A spacer is pushed between the two strips of material in the forming station to prevent the form punch from drawing the strip into the center of the die. Spring loaded pressure pads are used in the first forming station to insure square corners and to strip the stock off the spacer.

After the second forming operation the two strips of hinge wings pass on through the press for a distance of five to ten feet and are looped to return back into the front die section. They enter the die bottom side up with wings meshed together and are fed from left to right. Wire for hinge pins is fed into the die from a reel, passing through a straightener.

The wire is carried onto the hinge and a curling punch, *Fig.* 6, curls the formed ends of the loops so that the wire is permanently retained. In the next station the curled portion of the hinge is struck with a flat block, which tends to round the loops and in turn loosen the wire so that the hinge does not bind. If the hinge is a simple one, only one further operation, a cutoff, is required. The cutoff mechanism is similar to that used in the previous method described.

Proper guiding and feeding of the two strips of wings are of utmost importance to successful operation of the die. A hitch feed should be used in the front die section and it should be designed so that the feed finger pushes against one of the formed loops. This gives a positive feed and insures the correct progression required to hold the length of the finished hinge.

Many different types of hinges can be produced by adding appropriate work stations in the die. Hinges can be notched to give them a distinctive appearance. Prongs can be formed so that hinges can be clinched into metal or cardboard or driven into wood. Extra forms in the wings can also be readily produced, using added work stations.

Hinges made by this method sell at low cost due to the high production obtained. Rates of 10,000 completed hinges per hour are feasible with one machine and one operator.

In a variation of the method, the wire is permanently attached to the side of the press and is used only as a forming arbor. After forming, the hinge wings are forced off the wire and are assembled in a separate operation.

Many methods of minimizing the amount of material wasted in notching the strips have been developed and some of these have been quite successful. One method is to blank out a thin section between two loops of a hinge, *Fig.* 7. The space between the two loops is divided by selecting the right matching combinations, *Fig.* 8, providing clearance for all loops. Tooling for production by this method is relatively costly to make and maintain.

General Considerations in Tooling: Regardless of which hinge manufacturing method is adopted, there are several principles which apply to all hinge manufacture. One decision, which the die designer must make, is whether to pierce mounting holes before or after assembly of the

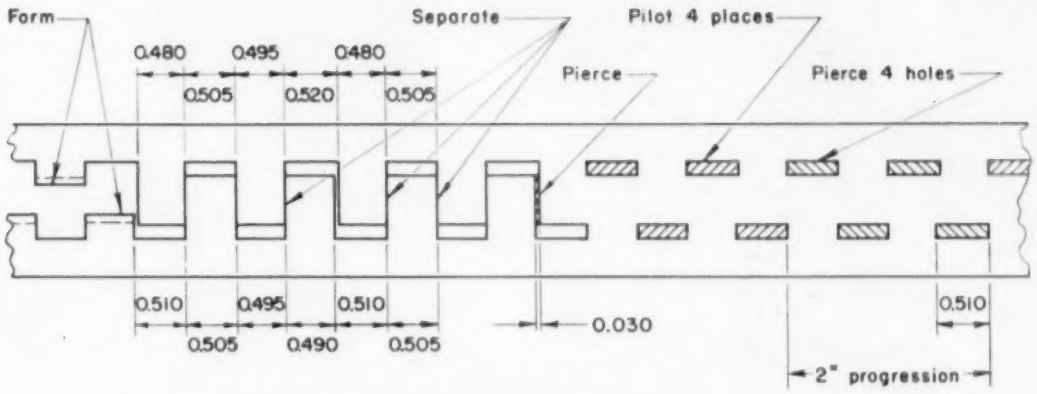


Fig. 7. Strip layout, in which hinges partially mesh, saves material. Space left by piercing 0.030-inch section is divided over several loops to provide adequate clearance.

hinge. It has been found that piercing the holes in short hinges prior to assembly gives good results; with long hinges it is better to pierce all holes after assembly. This insures that opposite holes in mating pieces are in line.

It would be desirable to broach the width of loops in the same progressive dies in which blanking and forming are accomplished. This method has never been satisfactory, however, owing to the difficulty of removing shavings from the die. The shavings get under the strip and interfere with proper functioning of the die. They may also deform the lower sides of the hinges.

Misfeeding of stock is one of the major causes of broken dies. This danger can be minimized by the use of precision limit switches which detect misfeeding and disengage the press clutch if the stock does not move forward the correct distance. Another good safety device is one which shuts off the press if an excessive load is placed on the punch holder. Use of such devices can prevent serious damage to a die if misfeeding occurs or if a piece is not properly ejected. An added benefit is that the operator is not required to watch the die operation so closely and can often run several presses.

Broken punches and pilots often cause extensive die damage. The best preventive measure is to design these parts so they are as strong as space will allow. Selection of the proper tool steel is also important. The constant pounding and vibration of the press may cause screws and dowels to loosen. Periodic inspection of the die, to see that all parts are held firmly in place, is the best means of eliminating the possibility of die damage from this source.

Each one of the three basic methods of hinge manufacture has its advantages and disadvantages. Manufacture of sheet metal hinges provides an unlimited opportunity for a tool engineer to exercise his ingenuity and resourcefulness in developing improved production methods.

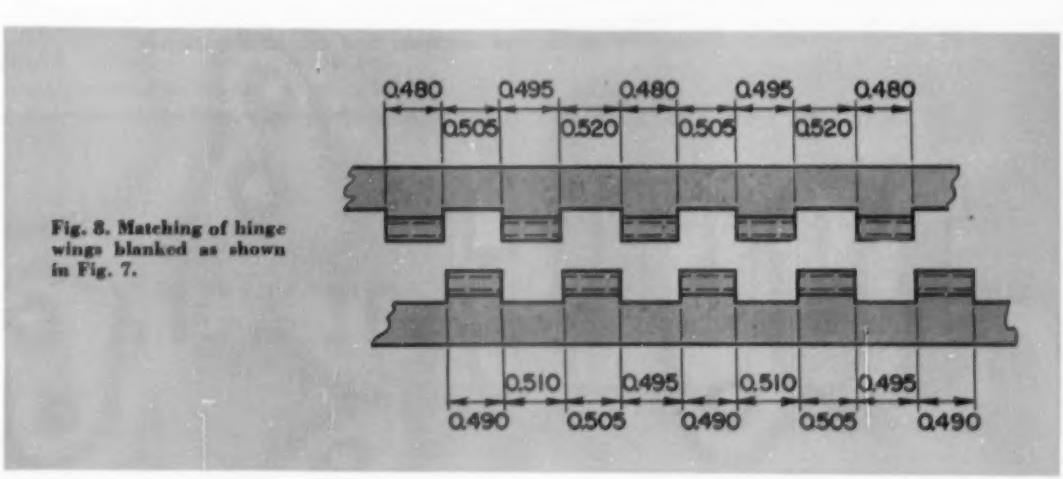
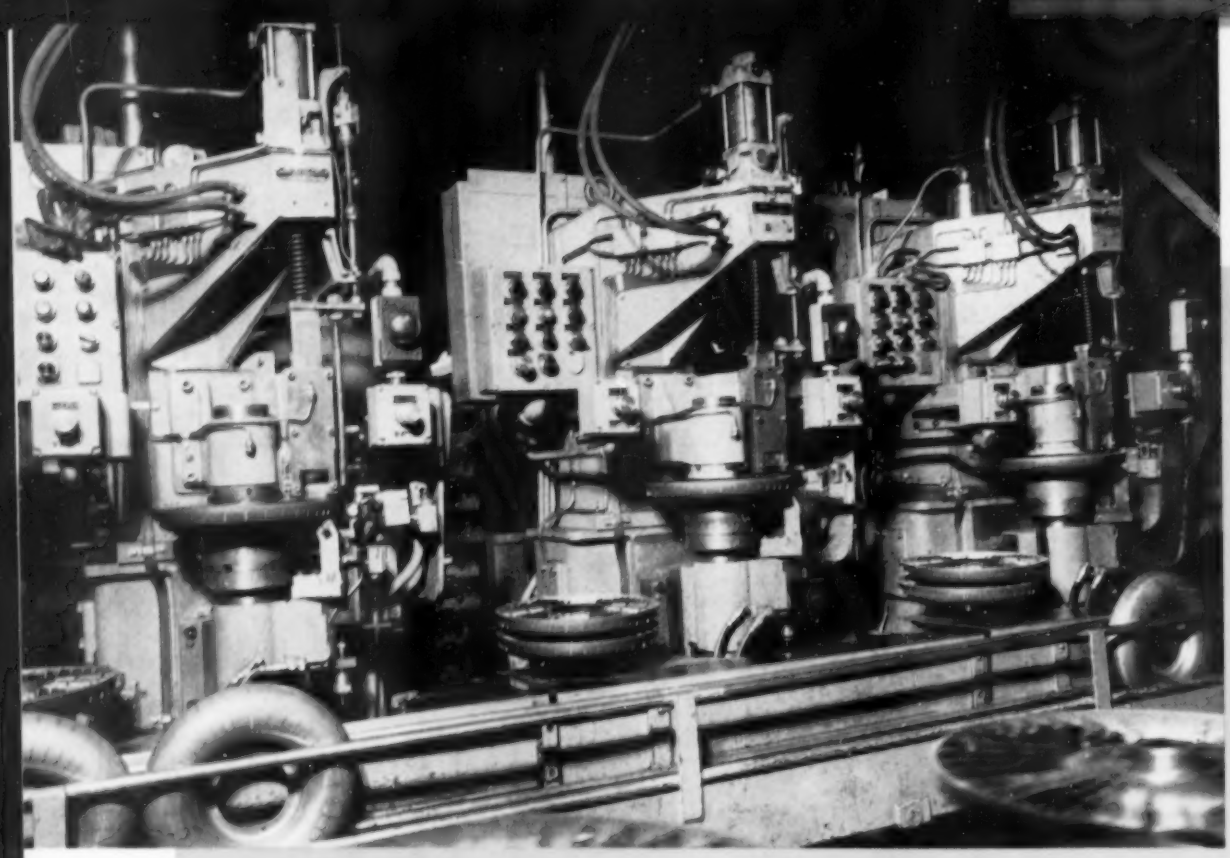


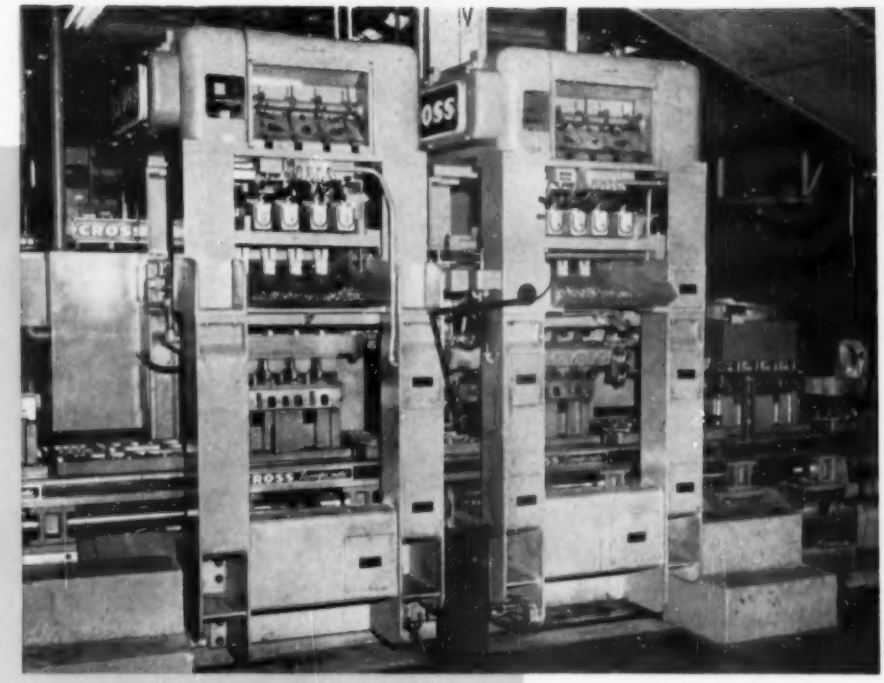
Fig. 8. Matching of hinge wings blanked as shown in Fig. 7.



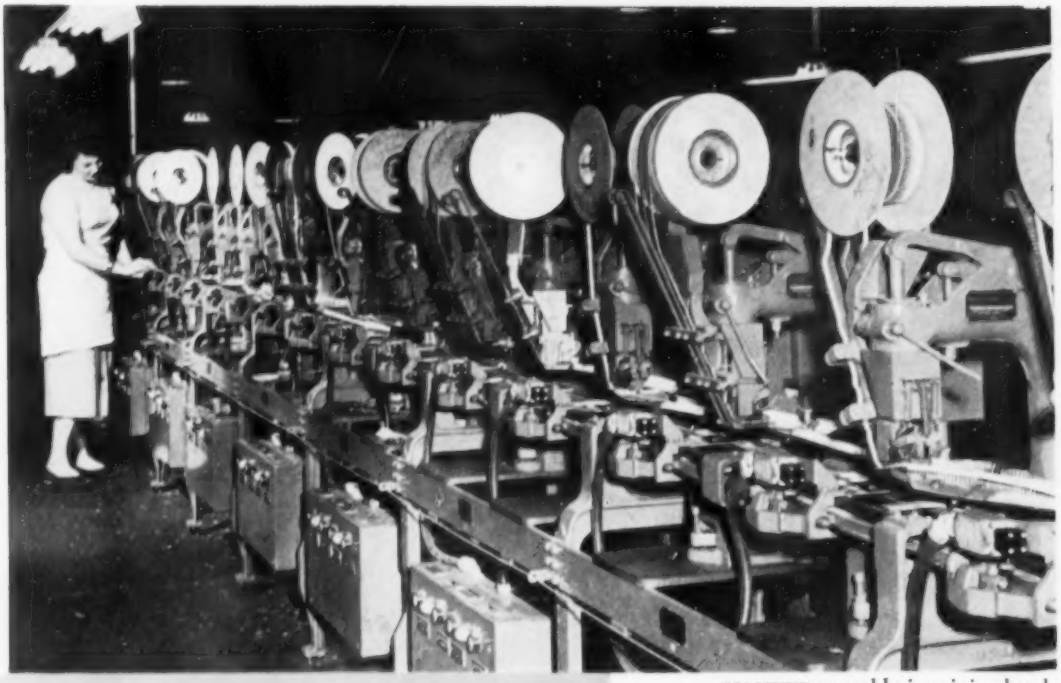
TORUS VANE LOADERS represent high production of a small assembly in a circular index machine at Detroit Transmission Div., G.M. Thirty-six vanes are fed into the torus shell in a cycle time of 26 to 29 seconds. Vanes are stacked in the magazine on right side of table. Static type controls are used. Loading and unloading of torus is manual.

Automatic assembly involves special machine tools which must meet exacting requirements. Since each application is different, as is apparent in these illustrations, success in this field depends upon ingenuity of the tool engineer and machine designer.

TOOLS at work

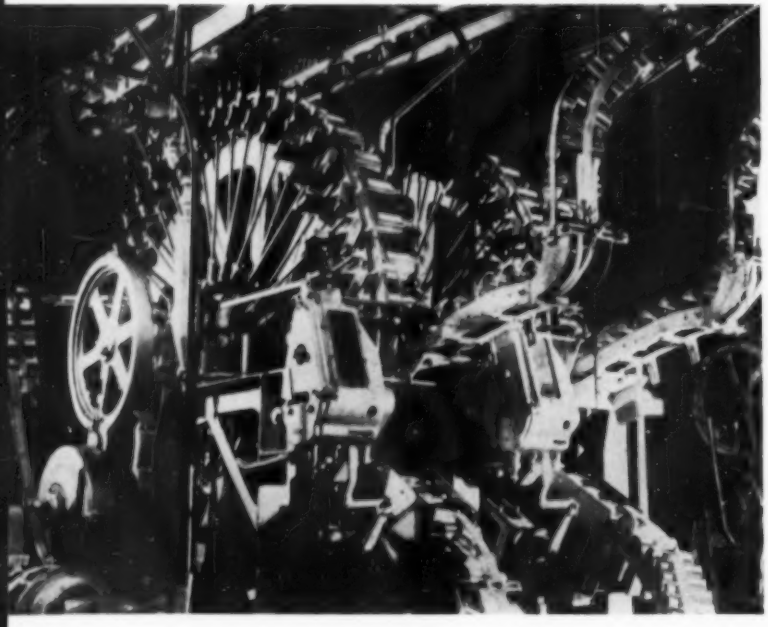


ASSEMBLY of valve springs in cylinder heads at Chrysler Corp., Mound Road Engine Plant. Gravity feed is used with hoppers at top of Cross-built machine. Valve locks, tapered cylindrical in shape and split lengthwise, feed down four tracks (close-up). The hopper is constantly agitated by blade type rotors located near the feed track opening. Improperly oriented parts fall off the track into center tray. Valve springs already loaded loosely on the head are depressed by four fingers, the locks drop into position and the springs are released. Checking is performed in a subsequent station.



MACHINE assembly is gaining headway in electronics industry. In this machine at RCA fifteen components are automatically inserted on printed-circuit boards. Each reel contains a separate component, which is inserted on the printed panel as it is moved under the head by conveyor. Position and number of heads are varied as demanded by the design.

TOOLS at work



AUTOMATION in the canning industry is well advanced as this joining operation indicates. Bottoms of cans are double seamed in place; then the cans are subjected to a high-pressure leak test. Defective cans are automatically rejected.

—Photo courtesy Continental Can

Fig. 1. Tension clamp and split die plate being used on a Cyril Bath contour former. Clamp, at the 6 o'clock position on the die plate, still grips the end of the extrusion at the finish of the forming operation. (Inset) Close-up of clamp shown at arrow on the die plate.

mechanical clamp speeds production

By Jack E. Strong*
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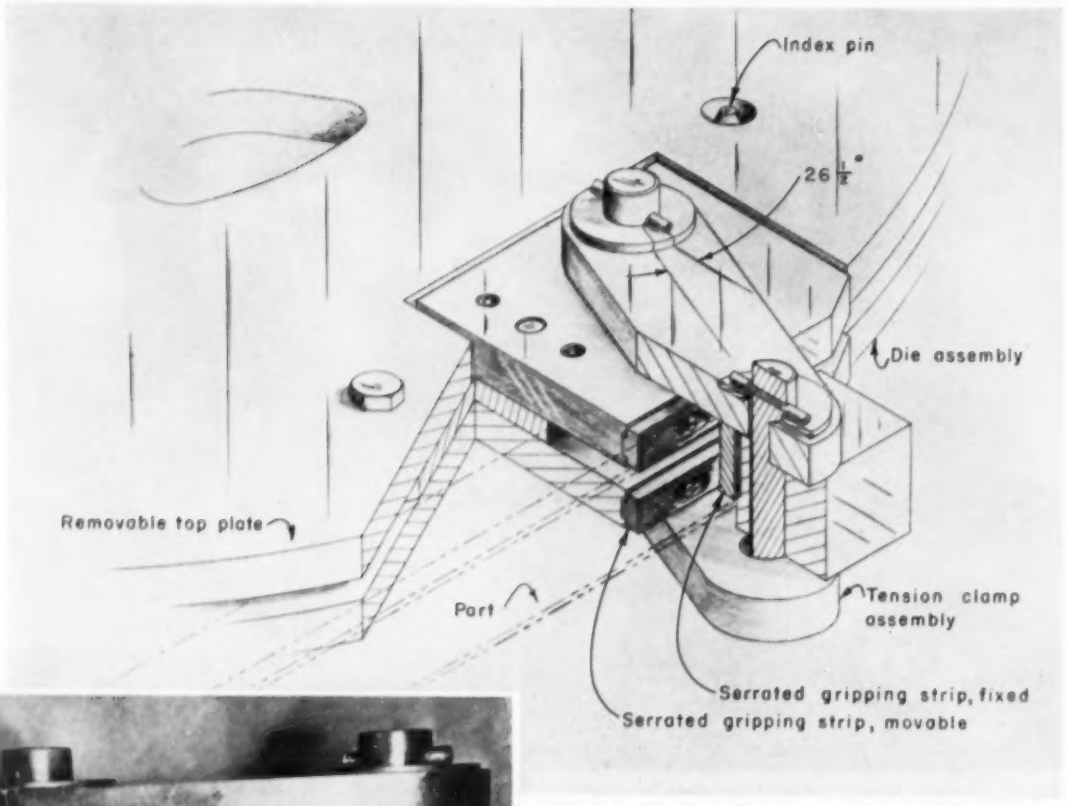
REDUCING SETUP time and eliminating special machines are not the only ways to increase production while decreasing manufacturing costs. Use of standard items can effect savings. By employing a serrated tension clamp in conjunction with a split die plate, for example, a costly spiral die and one set of jaw inserts were eliminated from the operation of forming heavy T-extrusions on a Cyril Bath contour former, *Fig.* 1. This permits compression wiping in a single plane and it eliminates the straightening operation that would be necessary if spiral forming

*Senior member ASTE Long Beach chapter.



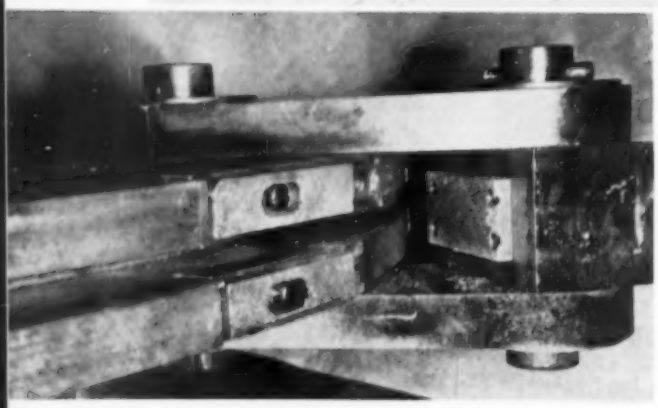


Fig. 2. (above) Drawing of tension clamp showing fixed and movable gripping strips. (Inset) Jaws as they appear on the actual tension clamp.

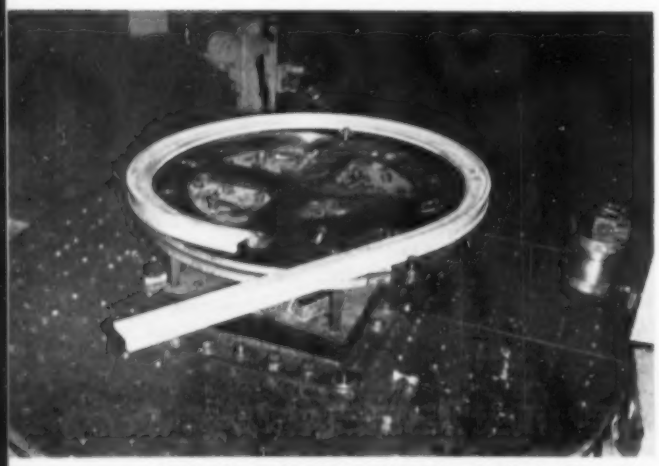


Fig. 3. Completed part after being unloaded from die.

were used. This method also permits the use of a shorter length raw extrusion, another over-all cost saving. With the top die plate removed, the part is easily loaded and unloaded, reducing machine down time to a minimum.

The extrusion is placed in the tension clamp, *Fig.* 2. which pivots from the rotating table, swinging in toward the table at an angle of 26 deg 30 min. The clamp holds the extrusion securely—the harder the pull of the stretch press jaw, the tighter the grip on the part. When the ultimate yield point is reached, the compression wiper is set at 90 deg to the part and the forming begins.

When stretch forming is completed, the pressure on both the wiper and the stretch-press jaw is released. The clamp is then tapped, releasing the part. The top die plate is lifted and the part unloaded, *Fig.* 3.

With this method, time is saved in both die fabrication and part production while maintenance and repair are reduced to a minimum.

ceramic investment shells

...give high-quality castings

By Nicholas J. Grant
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and

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The need for improved methods of precision casting has led to the development of several new casting methods. One of the most promising of these is the Glascast process, which utilizes lightweight ceramic shell molds. A program for the improvement of the process is described by the authors.

GLASCAST POWDER is a ceramic material which has outstanding properties when used in molds for precision castings. Among its advantages are a low coefficient of expansion, which permits molds to withstand severe thermal shock without danger of cracking, and a high melting point. When heated above 1850 F, the material is self-bonding without shrinkage.

In order to take full advantage of these characteristics, a method of applying the powder as an investment slip or slurry directly onto a disposable wax pattern has been developed. The resulting investment shells, *Fig.* 1, are light in weight, requiring only a small amount of ceramic per pound of metal, and have improved permeability. Under laboratory conditions, wax patterns can be made, shells built up, dewaxed and fired, and castings poured in one hour. In production, a 24-hour casting cycle appears feasible. The castings have fine grain and, because the shell is thin, cooling is rapid

Based on a paper given at the fourth annual meeting of the Investment Casting Institute

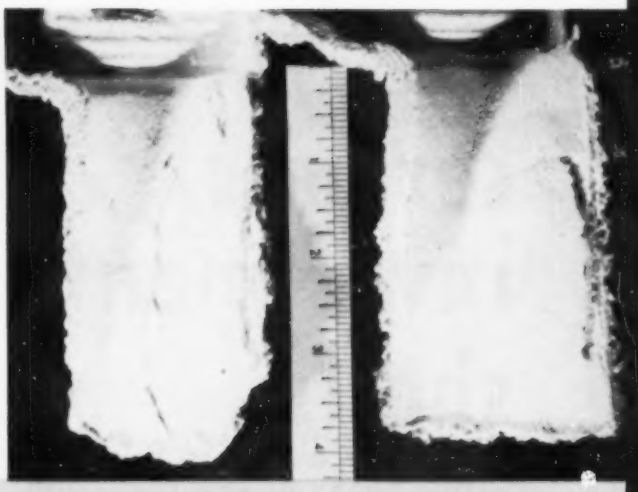


Fig. 1. (left) Glascast investment shell. This shell has been cut open to show the smooth interior surfaces. Successive coatings of ceramic material are visible at the edges of the shell.

Fig. 2. (above) Phosphate-bonded Glascast shell, fired at 1850 F. Left view shows layer separation inside cavity. Right view shows rough powdery surface and spalling.

and decarburization is minimized. Surface finishes are highly satisfactory. An added advantage of the process is that it can be used for casting both ferrous and nonferrous metals.

The first step in making castings by this process is to assemble a wax or plastic pattern of parts to be cast, plus sprues and runners. This assembly is dipped into a Glascast slurry and immediately stuccoed with either a coarser grade of Glascast powder or with foam silica and then dried. A second coat is applied by dipping and stuccoing again, followed by drying. From three to six coatings are built up in this way, giving a strong, continuous, thin shell around the pattern assembly. The investment shell is then dewaxed at the firing temparature, brought to the proper casting temperature for the workpiece material, and cast. Usually, no supporting material is required around the shell.

Shell Development: As is the case with any new process, the successful development of satisfactory ceramic investment shells was the result of a considerable amount of trial-and-error experiment. Early tests using an acidified water slip showed that it was possible to apply a thin adherent Glascast coating to wax, plastic or metal. Efforts to remove disposable wax patterns by conventional methods at 200 F, however, always resulted in cracking of the shell due to expansion of the pattern material.

A large variety of bonding agents such as ethyl silicate, Nalcoag and various phosphates were used to try to produce a slip with sufficient green strength to avoid cracking in low-temperature wax removal. None of these gave satisfactory results. Accordingly, further experiments were directed toward high-temperature dewaxing, on the theory that if the investment was placed in a furnace at 1850 F with the wax unexposed to hot gases except at the riser, the Glascast might achieve a high-temperature sinter bond before the heat reached the wax. Thus the shell would be strong enough to withstand expansion of the pattern. The experiments were successful. It was found that Glascast-coated wax assemblies can be directly inserted into a furnace at 1850 F without cracking of the shell.

The next problems investigated were the attainment of greater green strength and improved control over coating thickness. Some of the conditions encountered were the washing off of one coat when applying a subsequent coat, and too rapid or too slow drying of an applied coat, which interfered with stuccoing operations and slowed production rates. Related problems were cracking and spalling during firing, and uneven coating thicknesses. Coating thickness is particularly important because it

determines drying and cracking behavior, especially at corners or thin edges.

A number of different binders and coating mixes were tried out to overcome these difficulties. These included an acidified water slip, an ethyl-silicate slip, a Nalcoag G slip and a phosphate slip.

For casting tests, a rather large jet engine blade with both concave and convex surfaces was selected. Many tests were made, using a single-slip mixture for all of the three to five coatings required for a particular assembly, or using several slips for successive coatings on an individual shell. Good blades with superior surface finishes were produced with all slip combinations. However, each combination also gave a number of poor results.

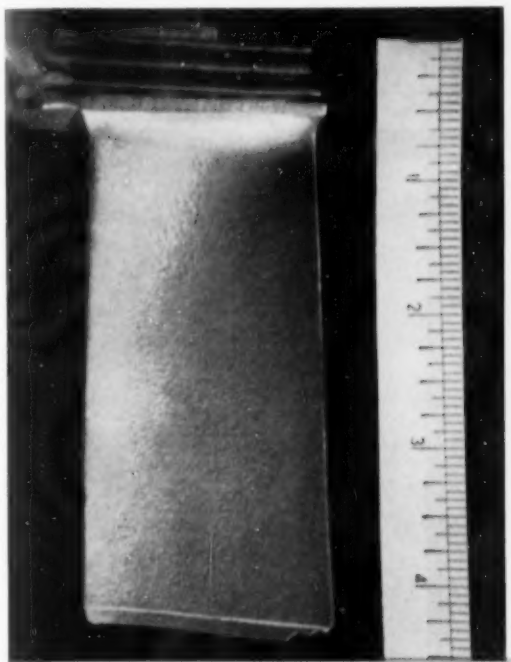
The use of a phosphate-bonded Glascast slip with foam silica stuccoing permitted the most rapid build-up. The resultant investment shell was only moderately strong, however, and some spalling of the primary coat took place, *Fig.* 2. Improved results were obtained by using Nalcoag or ethyl silicate slips for the first or first two coats and a phosphate-bonded slip for the next coat. The most common defect noted with this combination of materials was separation of the coats.

Other results of this series of tests were encouraging. In no instance was there evidence that an investment shell cracked due to direct insertion of a cold assembly into an 1850 F furnace for dewaxing. Similarly, cold molds did not crack on insertion into an 1850 F furnace or when withdrawn and cooled to room temperature. It was also shown that the molds could be handled without undue care and that they could be cast without supports or backing.

A further step in the development program was to make a study of the influence of particle size on flaking, spalling and separation of successive coatings. Coarser Glascast powders were added to the usual 325-mesh powder. A typical mixture which gives improved coating strength is: 75 percent 325-mesh, plus 20 percent 100 to 150-mesh and 5 percent 150-mesh Glascast powder.

A simultaneous study was made to determine the effect of the particle size of foam silica on the strength and stability of the primary coat. The results were compared to those obtained by using coarse crushed Glascast as the primary stucco material.

A group of turbine blade shells was made to evaluate the use of the coarsened Glascast slip and the graded foam-silica stucco layers. Nalcoag G Glascast slurry was used for the first coat, which was stuccoed with 35 to 48-mesh foam silica and dried in one hour. The second and third coats were made of phosphate slurry. Each coating was stuccoed with 10 to 16-mesh foam silica. Drying time was 15 minutes. Phosphate slurry also was used for the fourth and fifth coats. These coatings were stuccoed with



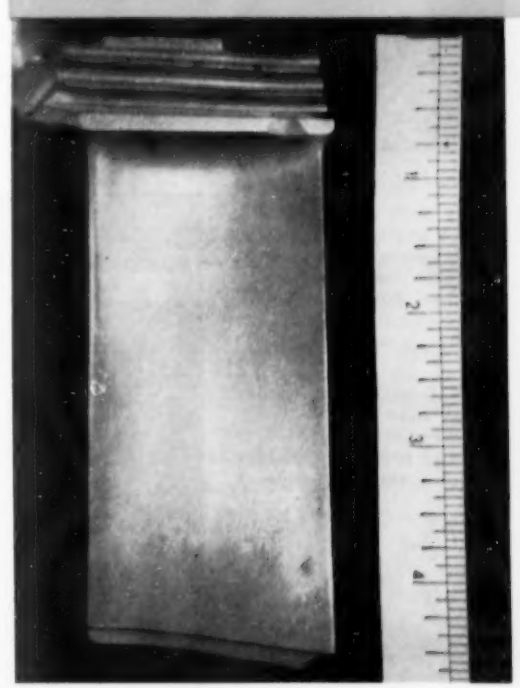


Fig. 3. (upper right) Cast turbine bucket (HS-31) showing "pebbling."

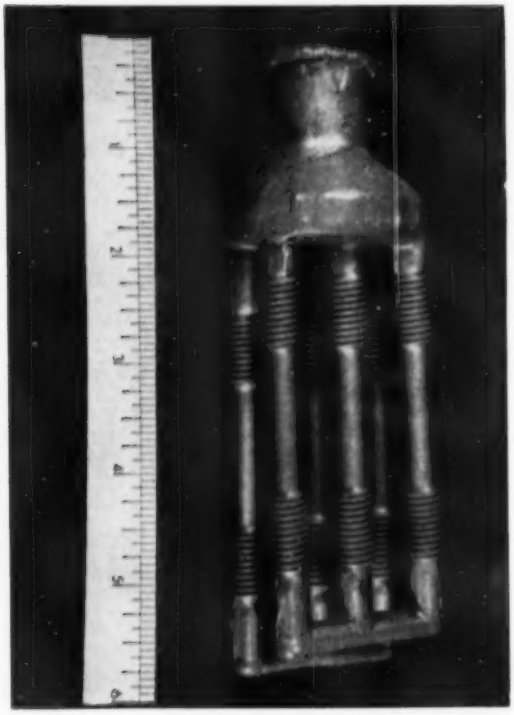
Fig. 4. (lower right) Excellent surface finish of this casting is the result of careful drying of the Glascast investment shell.

6 to 10-mesh foam silica. The fourth coat was allowed to dry for 15 minutes and the fifth coat was dried overnight.

A number of turbine blade shells were prepared, fired and cast. The major defect noted was occasional pebbling, *Fig.* 3, or an extremely fine craze cracking. There was little evidence of spalling or serious cracking. Most of the blades were considered acceptable but showed need for improvement.

Repeated experiments pointed to excessive moisture in the investment shell as the most frequent cause of spalling or serious cracking. Accordingly, additional shells were made using the same coating combinations, with controlled drying between coats. A water indicator, cobalt chloride, was added to each slurry. Using this indicator, the wet dip coat was pink in color, changing to blue on drying. With care in drying each coat, numerous blades having nearly perfect surfaces were produced, *Fig.* 4.

It was observed that Glascast slips, bonded with different chemicals, have different drying times. The effect of atmospheric humidity further complicates drying, and best results are achieved by using dried air at controlled temperatures. Cracks in any of the undercoats during build-up of the shell may result in water seepage into the coating underneath. In such cases, drying may take unusually long or water may be retained and result in cracking or spalling. The possibility of applying a sealer to successive coats as a means of moisture control deserves further investigation.



Pilot Casting Trials: More than 150 test bar assemblies, *Fig.* 5, have been cast, using the Nalcoag G primary coat plus four phosphate coats. The alloys cast include x-40 (HS-31), 18-8 stainless steel, plain carbon steels and chromium-base alloys containing from 35 to 60 percent chromium. The test bars, *Fig.* 5, have a 0.25 by 1.25-inch gage section with threaded ends. There are nine bars in each assembly. In the experiments, investment shells were fired and cast after storage periods ranging from one-half hour to 10 days. There was no deterioration of the green shells during storage, and not one of the test bar molds showed significant cracking, spalling or crazing. The metal surfaces were excellent. Apparently, in simple circular shapes, uniform hoop stresses are set up in the ceramic, and cracking and spalling are avoided.

Turbine blade shapes, on the other hand, have

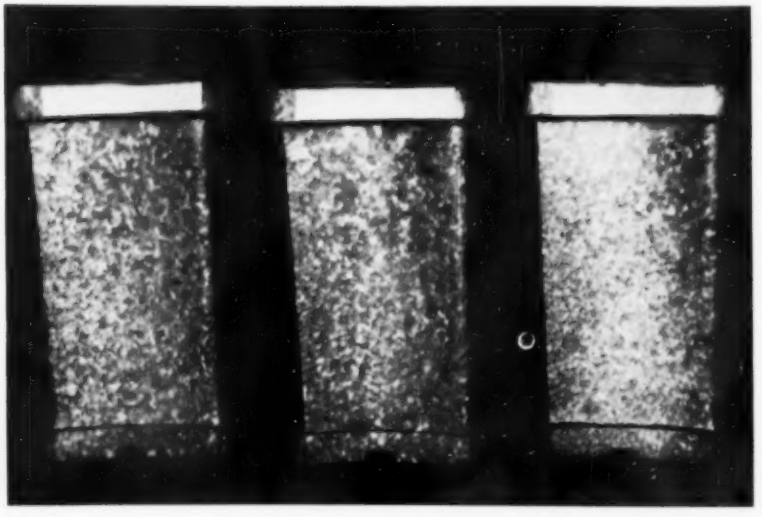


Fig. 5. (above) Tensile test bars were cast as assemblies and had good surfaces.

Fig. 6. (right) HS-31 alloy cast at 2650 F into Glascast investment shell preheated to 1600 F has fine-grained, uniform structure.

large flat areas and always include a concave and a convex surface, and consequently undergo differential strains at some stage of the shell production cycle or during firing. Of several hundred blades cast, using different binder combinations, only about 60 percent had satisfactory surfaces. Some of the rejected blades were salvageable by the usual grinding and reconditioning techniques. More recent trials using five coatings, all bonded with Nalcoag, with an ethyl silicate sealing coat between coating applications, have shown promising results when drying times were sufficiently long to prevent spalling.

Castings weighing up to five pounds have been made, using casting temperatures as high as 3100 F. The cast surfaces obtained by using the Glascast process are superior to those obtained in similar experiments with conventional investment materials. Glascast shells also have somewhat greater permeability, which permits increased use of static casting techniques without failures. When centrifugal casting methods are used, the shells must be backed up with ceramic; normally, however, there is no need for centrifugal casting.

In casting plain carbon steels into Glascast investment shells it was noted that the metal cooled much more rapidly than was true for the usual massive investment molds. This rapid cooling has resulted in finer grain size for a given combination of mold and metal temperatures, *Fig. 6*, and in significantly less decarburization.

On the average, the more rapid solidification and cooling in the Glascast shell result in less reaction between metal and mold for a given combination of casting conditions. This should have a beneficial effect on the surface of the metal and will avoid long or difficult shakeout for castings and extensive conditioning or surfaces. In tests it was observed that a four percent manganese stainless steel did not react with the Glascast mold but reacted severely with a conventional massive investment mold.

Further Development: Results obtained during the development program have demonstrated that the Glascast investment process merits extensive further investigation and application as a casting method. In a program which is quite young there have been, of course, many questions as yet unanswered. Dimensional corrections for master dies to obtain 0.005-inch-per-inch tolerances on castings will have to be worked out. Size limitations in terms of unit castings as well as total casting weight must be determined. With respect to shells, the maximum size, if any, which is castable without ceramic support, will be established.

Solving the Engineer Shortage

National Bureau of Standards operates a successful program to encourage student interest in science and engineering careers in an effort to meet present and future professional personnel demands. The plan, which actually has been in effect since 1948, permits physical science and engineering majors, as well as selected high school graduates who have shown unusual scientific ability, to apply their education in summer jobs in accordance with their interests. Work in the field also broadens the individual's experience as he becomes acquainted with other types of work carried on in Bureau labs.

Research endeavors in which the students engage range from nuclear physics to building technology and include such projects as development of a panoramic X-ray machine, the redetermination of g—the acceleration due to gravity—and studies at the Bureau's Boulder Laboratories on radio propagation by forward scatter techniques. A student who has taken part in the program and is recommended by his supervisor may return each summer while he is completing his education.

Approximately 150 students have been employed annually in this "summer career" program and thus have been exposed to the advantages of a professional career in engineering or science. Besides carrying their share of the work load during the summer, many fulfill the ultimate aim of the plan and later return as permanent staff members.

Still another, though allied, approach to meeting professional manpower shortage is the program being carried on at Chicago Apparatus Co. Here stress is laid on efficient use of scientists and engineers to accomplish the work load formerly requiring a greater number of professionals. This has been accomplished by freeing the most highly trained men from nontechnical details which can be handled by assistants and by taking advantage, where possible, of scientific instruments. In the matter of utilizing other employees to alleviate the strain on scientific personnel, the company has realized virtually the same effect as it would have had it increased its scientific manpower by 45 percent. On the other hand, use of new apparatus has reduced the time for some scientific determinations from days or weeks to a matter of minutes or seconds.

PROFILE TURNING
with positive-rake inserts

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Spectacular applications of negative-rake cutting have attracted so much attention that thought has not always been given to the needs of the job. This article shows that each job should be engineered and that worth-while advantages are obtainable with positive-rake tools.

RECENT ACCOMPLISHMENTS in the machining of slender shafts have dramatically demonstrated the value of indexable, button type tool inserts having positive rake angles. This tooling permits higher metal removal rates, smoother finishes, closer tolerances, better chip control and longer life than is possible with conventional tools under the same conditions. These shafts are automotive transmission output shafts and are processed on high-speed single-point profile-turning equipment, *Fig.* 1, with steel removal rates up to 1.8 cubic inches per minute for each horsepower available at the spindle.

For production of the shafts, the cutting tool is held in a tool block that is fastened to the slide of the tracer compound. The compound moves in accordance with the path described by a carbide stylus traveling over a template of the desired profile. This template is held between centers at the rear of the machine. With such a setup, the cutting tool can accurately produce chamfers, diameters, tapers, shoulder cuts, radii and undercuts.

Workpieces are supported between centers and are held by a hydraulically powered three-jaw chuck. The small end of the forging is held in the chuck. Chuck jaws have serrated carbide inserts for long life and maximum gripping power. Although it is also carbide, the tailstock center is considered as low-cost consumable tooling. It is inserted in a split type arbor and can be quickly and easily replaced if it becomes worn or broken.

A modified toolholder, *Fig.* 2, is used in this setup. Its SAE 4140 shank is hardened to 42 R_c to provide adequate support for the shimplate and to resist bending under cutting loads. The carbide shimplate provides a stiff and accurate seat for the cutting insert and can protect the tool shank in the event of a smashup. The precision-ground cutting insert is a wear-resistant carbide suitable for use at high surface speeds. A separate carbide chip breaker gives good chip control.

Effective, positive side and back rake angles of

*Senior members ASTE Detroit chapter.

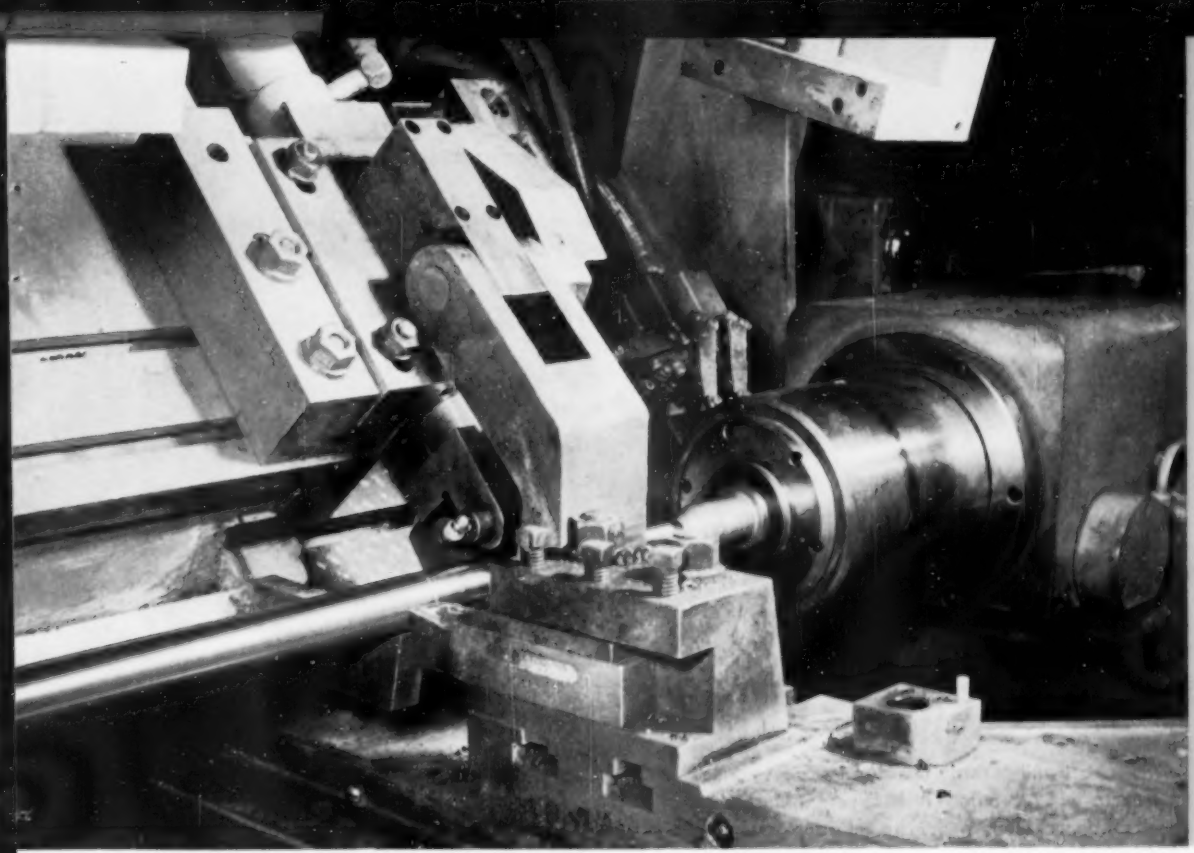


Fig. 1. Mounted on the tracer compound, the precision insert has effective positive side and back rakes. Consequent reduction of cutting forces results in ability to profile turn long, slender shafts without chatter.

10 deg are produced by the insert pocket in the toolholder. The insert is ground with 15 deg clearance all around so, when it is clamped in place, the effective clearance is 5 deg all around, including the $\frac{1}{32}$-inch-radius nose. Good work has resulted from this tool geometry with surface speeds of 700 to 1000 sfpm and feed rates of 0.013 to 0.015 ipr. Chatter, possible when turning such a long and slender piece, does not occur even though the part is completed from forging dimensions in a single pass.

The output end of the shaft, *Fig.* 3, is machined first. This operation is critical because of the small diameter and the necessary undercut. To insure against chatter that might result from dull tools, a roller rest supports the shaft. Motions of the rest are synchronized with cutting operations so it contacts and steadies the shaft about $4\frac{1}{2}$ inches from the end after that surface has been machined. Characteristics of the operation and setup are such that a follow type rest is not required to produce uniform diameters.

Profile turning is done dry in this setup. However, tool life has been extended 35 percent by application of a film of sulfur-base oil to the forging prior to turning. Tool life ranges from 50 to 60 pieces per cutting edge and results in tool costs of 1.3 to 1.0 cents per piece per operation.

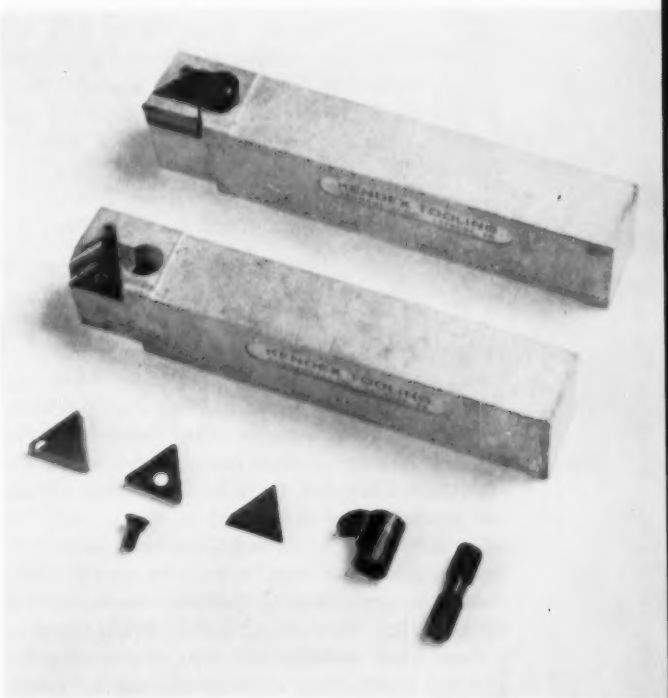


Fig. 2. The modified standard toolholder and parts, from left to right, the precision-ground insert, shim-plate, chip breaker, clamp and holding screw.

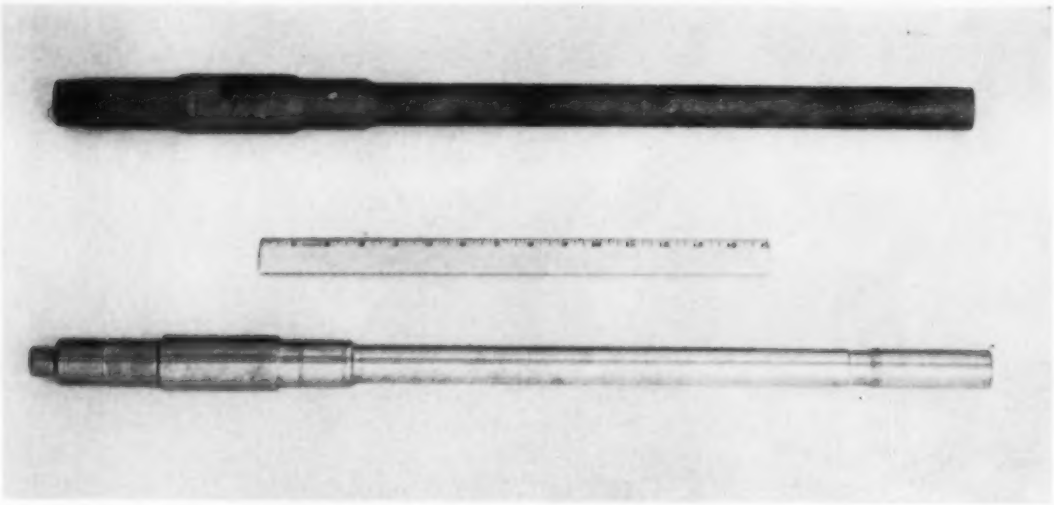


Fig. 3. Automotive trasmission output shaft, bottom, is produced from the rough forging, top, in a single pass on a profile-turning machine.

The first profile-turning operation removes metal at a rate of 7.2 cubic inches per minute and requires approximately 5.6 hp. Power available on this setup is ample and indicates the possibility of increasing the present feed rate to permit even higher metal removal rates. The second operation, that of turning the input end of the shaft, removes 18 cubic inches of steel per minute. This operation requires approximately 10.3 hp. In this setup, the maximum power surge, about 30 hp, occurs when the machine is started. About 30 percent of the available motor power is required to run the machine at full speed with no tools cutting. Metal removal rates of 1.3 and 1.75 cubic inches per minute per spindle horsepower indicate that tools with compound positive rake angles require minimum power. These findings may be the key to new concepts of tool geometry when accuracy, finish, runout, chip control, chatter and distortion are predominant factors.

During a quality capability check on this tooling setup, the micrometer dial on the tracer compound was held in a fixed position for a 60-piece run. Diameters, lengths, undercuts, roundness, runout, etc., adding up to a total of 11 position checks, were measured for every fifth piece. Final results indicated that this setup is entirely suitable for production of these shafts. Checks on the indexability of the precision-ground inserts showed that tool adjustment is unnecessary after indexing. The first piece turned after indexing the insert is within tolerances, as are subsequent pieces.

Centralized Fluxing Pays Off

Brazing operators at Westfield Mfg. Co., which manufactures bicycles, formerly mixed flux individually for their own use in silver brazing joints in bicycle frames. Result was a variation in consistency from one brazing station to the next.

To assure quality of its finished work as well as to accomplish the work more economically while saving operators' time, the company has centralized the operation. Now enough correct flux is mixed in a single batch to supply operators of several shifts. The flux is mixed and stored in an octagonal rotary drum from which operators refill their flux containers as necessary. Because the drum is completely closed except when flux is drawn from it, properties of the flux remain uniform until the supply is exhausted.

The drum containing the supply is rotated at about 40 rpm to provide a continuous mixing action. It is so set up that an operator can stop the drum to replenish his own flux supply without shutting off the motor. Vanes welded to the inside walls of the container provide sufficient agitation to maintain constant blending during rotation.

By this method the company has eliminated the problems of thin fluxes that run off workpieces and prevent the brazing alloy from wetting uniformly, or thick fluxes which are hard to apply evenly and are wasteful.

how to machine plastics

part three— secondary operations

By Robert A. Wason
Associate Editor

In this last of a series of three articles on the machining of plastics, specific information is presented for milling, drilling, tapping, threading, planing, shaping, routing and broaching plastics. Although the basic tools and methods are similar to those used when machining metals, speeds, feeds and tool geometrics are altered to take into account the different properties of plastics.

As with the operations mentioned in Parts 1 and 2 of this series, success in the secondary machining of engineering plastics is usually preceded by an understanding of the characteristics and properties of the particular materials being worked. No published data can anticipate all the machining conditions likely to be encountered—to say nothing of the families of new plastics that are being introduced daily—but the specific information outlined will provide a better-than-good starting point.

Milling: Laminated plastics can be milled, *Fig.* 1, with standard tools, and at speeds and feeds similar to those used with bronze and soft steel. The production feed rates used are determined by the type of surface finish desired. Best surface finish is produced on cotton-fabric-base phenolics when the cutter is run at highest possible speed with the maximum feed possible. If conventional high-speed steel cutters are used, they should be operated at speeds not to exceed 1000 sfpm. Even though tool costs may be higher, the use of carbide milling tools is frequently justified. When milling laminates, cutting action of the mill will be improved if the cutter is ground with a slight rake. Negative rakes up to -10 deg are advisable when milling laminated phenolics.

Splitting of laminates at the end of a milling cut can be prevented if the workpiece is backed up by a piece of wood or other rigid material. Because of the possibility of splitting, milled slots in laminates should not be closer together than the depth of cut and the first slot should preferably be farther from the edge of the workpiece than the depth of cut. Whenever possible, all material should be removed in one pass, and special care should be exercised on cuts that would tend to cause delamination.

Gear grades of laminates can be cut using the same procedures as used for milling regular grades. When hobbing gears, a hob speed of not less than 140 rpm is recommended for 3 and 4-inch pitch diameter hobs. Good results have been obtained with hob speeds of 800 to 900 rpm when using 8 inch diameter carbide-tipped tools. Feeds vary from 0.040 to 0.080 inch per revolution of the gear blank.

In gear-grade laminates, the gear can be hobbed to depth in one pass; roughing and finishing cuts are not necessary. If a standard metal-gear cutting machine will be used for cutting a long run of laminated gears, it may be worth while to alter the gearing to increase surface speed and feed rates.

Milling of glass, graphite and asbestos laminates should be accompanied by flush cooling, and the cutter speed should be reduced. Feed should be increased. Climb, rather than conventional milling,

Photo courtesy Westinghouse Electric Corp.

Fig. 1. Form milling of laminated plastic part. Holding fixture maintains even pressure along part without causing distortion.

is better with these hard-to-machine grades because it reduces friction and tends to clear chips. Climb milling also prevents edges of the material from being raised and tends to hold the workpiece in the fixture. Zero-rake carbide cutters work best and parts should be backed up to prevent splitting. If partial slots do not emerge to the surface with the contour of the cutter, subsequent operations are required.

Standard milling cutters can be used on rigid vinyl sheet but higher speeds are feasible if extra clearances are ground on the cutter blades. Whenever possible, spiral milling cutters should be used, and at least two teeth should contact the work at all times. Plain cutters should not be used because they develop excessive heat from side friction. Also, less friction is developed if a cutter takes the heavy part of the chip first, as when climb milling.

It is desirable, and may be necessary, to use a high-velocity air blast aimed at the milling cutter edge to provide cooling and to insure chip removal. Because the rate of heat transfer is so slow through sheets of rigid vinyl, attempts to cool the sheet by machining it while it rests on a cool metal plate are usually ineffective.

Fixtures used when milling rigid vinyl should be designed to minimize part distortion. Accuracy of finish-milled rigid vinyl parts can be bettered if the part is provided with adequate backup during the cut.

Cast phenolics can be milled with standard cutters on standard machines. Molded phenolic parts, on the other hand, are best milled with cutters that have a slight negative back rake and about an 8-deg side clearance. When small numbers of molded phenolic parts are involved, high-speed steel tools can be used at peripheral speeds from 100 to 150 sfpm. Stellite tools wear longer and have better heat properties, and can be used at speeds between 200 and 300 sfpm. Tungsten carbide milling cutters can be used at speeds between 300 and 400 sfpm.

Standard cutters with extra clearance are satisfactory when milling polystyrene. Fly cutters can also be used successfully. Milling cutter speeds should range from 2000 to 6000 rpm, depending on the width of the cutter. Feed rates also depend on the width of the cutter, feeds being reduced with increased cutter width and depth of cut. With a ½-inch-wide cutter, the maximum depth of cut should be about ⅛ inch. With a 2½-inch-wide cutter, depth of cut should not exceed 1/16 inch.

Milling cutters for use on polystyrene should be carbide tipped and should have clearance angles varying from 12 deg on a ⅛-inch cutter to about 4 deg on a 3-inch cutter. When carbide-tipped cutters are not available, standard high-speed steel cutters can be used. A flat spiral mill, operating at 600 to 750 rpm, is recommended.

Coolants should be used liberally during all polystyrene milling operations. Air blasts can be used, but "wetting" liquid coolants are more suitable.

The various grades of nylon can be milled easily. Best results are obtained when high cutter speeds and light feeds are used. Because developed cutting forces are not high, work-holding requirements are not stringent, *Fig.* 2.

Drilling: Ejection of chips is of extreme importance when drilling plastics. Drill design must anticipate and prevent the tendency for chips to stick and pack in the flutes. If packing occurs, rubbing and overheating result. This can ruin the hole finish and perhaps lead to drill failure. A

substantial clearance on the cutting edge of the flutes results in a smooth hole. Wide, polished flutes and chromium plating are both used to prevent packing. Large helix angles also help to expel chips quickly. Fast-spiral drills are normally used on blind holes and slow spirals on through holes.

For drilling small-diameter holes in most molded plastics, a drill with a 60-deg included point angle is used. Clearance at the periphery is 10 to 12 deg. For drilling large-diameter holes, drills with 90 to 120-deg included angles are used. On these larger drills, the heel behind the cutting edge should be ground away, leaving a land about $\frac{1}{16}$ inch wide. This reduces friction in the bottom of the hole and provides additional chip clearance.

If drills have a tendency to pull when breaking through, it is advisable to slightly flatten the front of the cutting edge as is done on drills for soft brass. Through holes should be backed up with wood and feed should be reduced at the time of breakthrough. Webs of drills used on plastics should be thinned as much as possible to reduce friction and consequent heat at the drill point. Reducing the friction between drill and material by grinding the drill off center will often prolong the life of the drill, especially where abrasive fillers are encountered. This technique results in a slightly enlarged hole. High-speed steel drills are satisfactory but carbides should be considered for long runs.

ACRYLICS: Twist drills commonly used for soft metals can be used for acrylics but better surface and higher production result with modified or special drills. Cutting edges of twist drills should be "dubbed off," *Fig.* 3, to zero-degree rake angles so they scrape rather than cut the material.

Holes in acrylic parts are classified as shallow, medium or deep, depending on the ratio of hole depth to diameter. Ratios for shallow holes are less than $1\frac{1}{2}$:1; for medium holes, $1\frac{1}{2}$:1 to 3:1; and for deep holes, greater than 3:1. Characteristics of drills used on acrylic jobs are listed in the accompanying table.

Chip removal is no problem for shallow holes in acrylic, *Fig.* 4, and coolants are unnecessary. Large-diameter holes can be cut with hollow end drills, fly cutters or trepans. Trepanning cutters should be ground with zero rake angle and given sufficient back clearance. Flutes on drills for medium holes should be as wide as possible to help in clearing continuous-ribbon chips. The included point angle varies between 60 and 140 deg, depending on the the size of the flute. Feed of drills in medium holes should be controlled so a continuous chip is formed and cleared without overheating the plastic at the tip of the drill. Coolants are unnecessary with holes of this size, but a jet of compressed air directed into the hole can be helpful. Drills with extra wide spirals and compressed air cooling can clear a continuous chip from holes with ratios up to 5:1.

The wider tip angle of deep-hole drills results in a shorter cutting edge and a narrower chip. Feed should be slow—about $2\frac{1}{2}$ ipm—so that powder rather than continuous chips is formed. A coolant is necessary when drilling deep holes in acrylic to avoid scoring or burning the surface. Compressed air can be used as a coolant for holes with ratios up to 5:1. Water or a soluble oil-water coolant can also be used. When applied at the entry hole, however, a liquid is pumped out by the drill and seldom reaches the tip.

A standard oil-hole drill can be used to insure proper distribution of the coolant. Coolant can also be applied by filling a pilot hole drilled 95 percent of the way through the material or by means of a pilot hole drilled from the opposite side of the work. Cleaner, more transparent deep holes can be produced by drilling a pilot hole a little more than half the diameter of the desired hole, filling the pilot with wax and redrilling. Drilling speed should be the highest that does not result in drill wobble. Large diameter drills require slower speeds. With adequate fixtures and good clamping, acrylics can be drilled with tolerances of $\pm$ 0.030 inch in hole location and $\pm$ 0.010 inch in diameter.

STYRENES: In general, polystyrene can be drilled with high-speed steel drills of the type described at the start of the drilling section. Included-point angles can range from 60 to 90 deg, *Fig.* 5, and lip clearance angles can vary from 12 to 15 deg. For deep holes and for holes with diameters of $\frac{3}{8}$ inch or less, sharpening of the web, practically to a point, is desirable. Care should be taken so that geometery

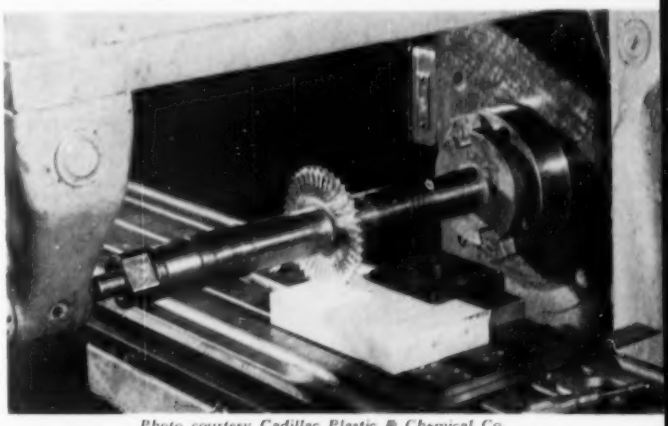


Photo courtesy Cadillac Plastic & Chemical Co.

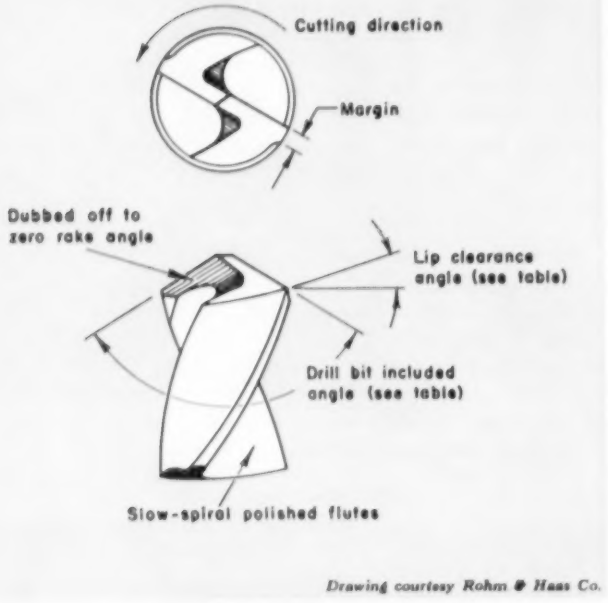
Fig. 2. Even when milling slots in nylon by conventional techniques, work holding can be simple, as shown in this insulator-milling setup.

of the drill is not altered by such grinding. Annealing of drilled parts is not necessary when they are small but should be considered for large parts.

Carbide form drills or carbide-tipped straight-flute drills work well in polystyrene. A negative rake, up to –8 deg, gives the best results on carbide drills for polystyrene drilling. Such drills should be stoned to remove all burrs.

Drills should be fed at such a rate that 0.001-inch-thick chips are formed with a 1/16-inch-diameter drill and 0.005-inch-thick chips are formed with a 1/2-inch drill.

When drilling small holes, the drill should be backed out frequently to clear chips. The high-spiral polystyrene drill, used for blind holes, has a helix angle of 40 deg for drills from 0.0400 to 0.2812 inch in diameter and 45 deg for drills 0.2813



Drawing courtesy Rohm & Haas Co.

Fig. 3. Drills for acrylics have the cutting edges dubbed off so they scrape rather than cut.

up to 0.5000 inch in diameter. High-spiral drills for polystyrene do not have body clearance.

High-impact styrene and cross-linked polystyrene can be drilled with high-speed steel drills having wide flutes and generous side relief. Other drill characteristics are the same as those of drills for regular styrene. Drill speeds for holes in high-impact styrene are determined by drill side: 1/16 inch, 5000 rpm; 1/8, 3000; 1/4, 1700; 5/16, 1700; 3/8, 1300; 7/16, 1000, and 1/2, 1000. For cross-linked polystyrene, uniform feeds of 0.005 ipr, high speeds and use of oil combine to give transparent finishes to holes. Frequent backing out of the drill is also a help to surface finish because such action clears chips and prevents scoring. To prevent chipping the exit ends of through holes, tendency of the drill to pull through after the point clears the piece should be resisted.

NYLON: Drilling creates more heat in nylon than any other nylon machining process. Because of this, extra care is required. Drills should be properly sharpened frequently. If standard drills must be used, the included point angle should be 118 deg and lip clearance should be between 10 and 15 deg. The lip rake should be ground off and the web thinned. To permit high-speed operation in shallow holes and to facilitate drilling of small holes, the drill can be ground slightly off center. This will make the hole larger than the drill and will minimize expansion of the nylon. Drills should be backed out frequently when drilling hard nylon because chips tend to melt and clog the drill flutes.

A slow-spiral drill gives the best results when working on nylon. Included point angles should be between 80 and 90 deg and lip clearances can vary from 9 to 15 deg. Drills should operate on the center line of the machine and should be held as short as possible. Since low feed rates result in overheating, feeds should be as high as possible, consistent with the desired surface finish. Maximum feed rates range from 0.005 to 0.007 ipr for a 1/16-inch drill, to 0.015 to 0.020 ipr for a 1/2-inch drill. For larger drills, *Fig.* 6, feeds of 0.020 to 0.025 ipr can be used. Maximum feed can only be achieved with coolants. Optimum drill speed varies with the job. First estimates, for a 1/8-inch drill, should be somewhere between 2100 and 3000 rpm.

When high accuracy is desirable, moisture content of the nylon must be known and special finishing steps may be required. When drilling a series of small holes, it is a good idea to insert a pin in each hole after drilling. This prevents the material from bending away from the drill, which could cause subsequent holes to be out of round.

It is often advisable to use special reamers—with greater-than-normal clearances—for finishing holes to size. Expansion type reamers should be used because, owing to the resiliency of nylon, reamed holes tend to be undersize. At least 0.010 inch of stock should be left for reaming. A satisfactory cut cannot be achieved with less stock because the cutting edge will slide over instead of cutting the material. It is often convenient to finish large holes to size with a single-point boring tool.

Polyethylene and fluorocarbons can be drilled by the methods and tooling applicable to nylon. On drills for polyethylene, the float angle should be

about 17 deg; the included point angle should be 70 deg; and the lip clearance angle should be 4 to 8 deg. Also, a polished land, one-quarter the width of the heel, can improve performance when drilling polyethylene.

RIGID VINYL: This material can be drilled in much the same manner as other plastics. For holes where depth is greater than twice the diameter, drills with extra-large flutes should be used. Drills should be ground to reduce end resistance, and the area of the cutting surface should be reduced to approximately one-third of the normal to lessen heat build-up.

Feed rates should be as high as possible so the drill will be in the workpiece for as short a time as possible. With short drilling times, the tendency to raise burrs around the edge of the hole is minimized. With mechanical feeds, the following cycle should be set up: approach fast, reduce feed for 0.010 inch until drill is through surface, increase feed to production value, dwell for 2 to 5 revolutions at hole bottom and withdraw as rapidly as possible. Drill speed should be between 4000 and 6000 rpm for small holes. When rigid vinyl is drilled properly, the chip will emerge in a tight spiral similar to that found when drilling mild steel.

Close-fitting drill bushings should not be used in jigs when drilling rigid vinyl because they may increase friction and prevent proper chip removal. If a jig is necessary, a floating leaf or template is advisable. The template should be removed after the hole is started. Pilot holes should also be avoided, except when the hole is to be reamed or counterbored.

PHENOLICS: Production of drilled holes in molded phenolics can be doubled or tripled if an air blast is aimed at the drill so the air will reach the point. Drills ground to a 60-deg included-point angle are the most satisfactory, especially when drilling through holes. More power is required with such points but feed pressure is reduced and potential chipping of through holes is lessened. The most important factor, relative to chipping of through holes, is the area of workpiece material remaining near the end of the drill stroke. Since the large-included-angle drill requires greater feed pressure and has more material, *Fig.* 7, remaining near the end of the stroke, it will cause more chipping than the sharply pointed drill.

Reducing friction between the drill and the workpiece will prolong the service life of the drill. This is especially important during long runs and when filled phenolics are used. Friction can be reduced by grinding the drill slightly off center or by plating the drills with hard chrome. Carbide-tipped drills are also used on abrasive parts and for long runs to increase tool life.

Standard high-speed steel drills up to $\frac{3}{16}$ inch in diameter, are satisfactory for drilling phenolic castings. For larger holes, special plastic drills with polished flutes and large clearances should be used. Dull drills cause burning in cast phenolic parts.

LAMINATED PLASTICS: Workpieces of these materials are drilled differently than other plastics simply because of their laminated structure. All through holes in laminated-plastic parts should be backed up with wood or other soft but rigid materials. When drilling at right angles to the laminations, material should be clamped between jig plates. If the drill penetrates the bottom plate, breaking out at the bottom and lifting of the top will be minimized. When thin pieces are to be drilled, they should be stacked to a height not to exceed $\frac{1}{2}$ inch. This limitation is necessary because drills smaller than No. 10 tend to run off center in

Acrylic Drill Characteristics

Drill Characteristic	Hole Type		
	Shallow	Medium	Deep
Included Point Angle, deg	55-60	Depends on flute size	140
Flute	Wide	Wide	Wide
Helix	Slow spiral	Slow spiral	Slow spiral
Rake Angle, deg	0	0	0
Lip Clearance Angle, deg	15-20	12-15	12-15

Photo courtesy Cadillac Plastic & Chemical Co.

Fig. 4. Shallow holes can be drilled in acrylics without coolants and without special provision for chip removal.

laminates thicker than ½ inch.

When drilling parallel to laminations, the tendency of the drill is to split the material. To overcome this, the included angle of the drill point should be increased—flat or bottom drills give good results—and side pressure should be applied. Steeper twists and wider flutes are desirable when drilling parallel to laminations. Also because of the nature of laminated materials, they have a tendency to bind on the drill and to close in when the drill is removed. To drill the required size of hole in laminated plastics, a slightly oversize drill should be used.

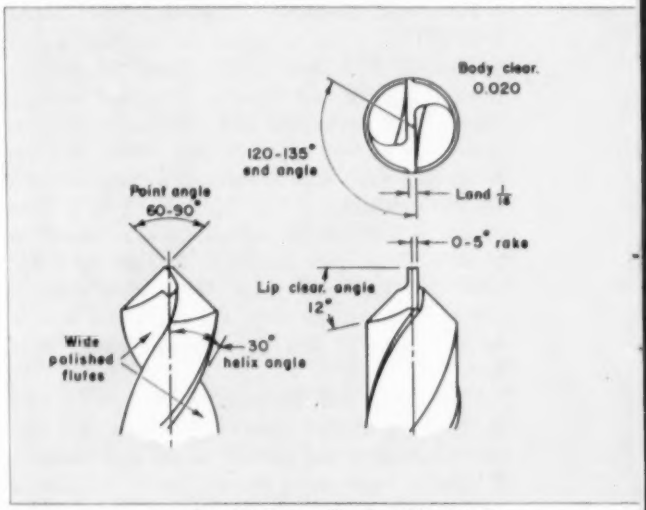
Tolerances can be held closer on drilled holes than on punched holes but rarely is the accuracy of a drilled hole necessary if the hole can be punched. Required drilling accuracy can usually be achieved with standard high-speed drills with lips backed off to provide plenty of clearance. The usual drill has a 60-deg included-point angle and zero rake. Drills with points ground to a 50-deg included-point angle give best results for holes under $\frac{3}{16}$ inch in diameter. They should be operated at the highest possible speed that does not cause burning—about 400 sfpm for high-speed steel drills.

For long production runs, deep holes and abrasive grades, carbide-tipped drills are best. Feed should be light and uniform and speeds should be high. With carbide tips, drill speeds may be as high as 16,000 rpm.

Holes larger than ¾ inch in diameter can be drilled using a radial drill press or can be formed with the counterbore method in which a pilot hole is drilled first. Countersinking can be done with a countersink or a twist drill. When a drill is used, it should have little clearance on the point and, if chattering occurs, the speed should be reduced and the cutting point should be broken on the inside of the flute. Generally, two-lipped drills are used as countersinks. They are given negative rakes to −10 deg and are run at speeds up to 200 sfpm. They should be fed by hand with a light touch in order to break the polished surface without cracking.

Laminated plastics can be trepanned, which is a useful technique either for making large holes or for producing workpieces such as gear blanks. Flycutting can be done with a single or two-point cutter held in an adjustable cutter bar. Flycutting capacity is up to 6 inches in diameter by 1 inch thick. Cutters should be designed with clearance both in front and inside of the cutting edge. A pilot in a previously drilled hole should be used to steady the flycutter. Flycutters should be fed by hand with care to prevent digging in when approaching the workpiece.

Normally, laminates are drilled dry. Coolants can be used to advantage, however, when drilling asbestos, glass or graphite base laminates. Drilling these grades with anything but carbides should be avoided. Drill flutes should be highly polished and the lip of the drill should be dubbed to provide sufficient clearance. Drills should be operated at the highest speed that does not cause burning. To avoid chipping and grabbing when drilling thin material and tubing, the included-point angle can be modified to as low as 60 deg. For holes deeper than 1 inch in these abrasive grades, the drill should be ground off center. For a true hole with fine finish, it is advisable to make a final cut with a carbide bit in a boring tool.



Drawing courtesy The Dow Chemical Co.

Fig. 5. Drill used for small holes in polystyrene. Large-diameter drills have point angles from 90 to 120 deg.

CELLULOSE PROPIONATE: For drilling round, smooth holes without burrs or skinning in cellulose propionate moldings, the following drill design should be used: helix angle, 37 deg; clearance angle, about 40 deg; cutting angle, 121 deg; rake angles, zero and webs should be thinned slightly. Peripheral speeds between 125 and 150 sfpm can be used if soap is applied as a lubricant. Continuous feeding is possible with drill sizes up to $\frac{9}{64}$ inch. Intermittent feed results in better holes for larger sizes of drills.

CHILLED PLASTICS: When drilling chilled plastics, it must be remembered that along with the desired stiffening effects of refrigeration, there is also a tendency toward embrittlement. Holes should be started slowly, with the drill speed increasing after entrance. On through holes, reduced speed at breakthrough reduces chipping.

Coolants are not generally used when drilling chilled plastics. Carbide drills are used for long runs and deep holes. For production work, both the cutting edges and the flutes of the drill should have a high polish.

Tapping and Threading: Acrylics can be tapped and threaded with standard tools for copper and brass but it is preferable to modify them to produce threads with rounded grooves to avoid cracking at the apex. Heavy, coarse threads should be used. Machine speed for power tapping or threading should be at least as slow as that used for copper or brass and taps should be backed out periodically to clear the thread of chips.

It is advisable to avoid threads or thread inserts in polystyrene because of the stress-raisers they introduce. Self-tapping screws should be avoided unless loads are light. Attachment methods which do not result in stress concentration points, should be considered. Fine threads are seldom successful. When threads are necessary, however, they can be cut.

As with drilling, the major problem encountered when threading polystyrene is heat. Coolants should be applied freely in all threading and tapping operations, regardless of the machine, method or tools used. Powdered zinc stearate can be used as a tap lubricant. Before tapping, a hole should be drilled or molded large enough to permit only 75 percent of the full finished thread. This avoids sharp threads and the tap can be easily cleared. Annealing should be done after drilling rather than after molding, unless the basic hole is molded, so that both molding and drilling stresses will be relieved.

Standard high-speed steel taps and dies may be used for making polystyrene threads in a tapping machine or by drawing rods through the headstock of a lathe. Spindle speeds should be 28 rpm for external threads of the American Coarse Series on rods up to ¼ inch in diameter. For larger diameters, external and internal threads can best be cut on a lathe with a threading tool and spindle speeds up to about 685 rpm.

Standard 3-flute taps with large, polished flutes should be used on styrene parts because they provide more chip clearance space than 4-flute taps. Slight rounding of the thread bottoms helps extend the service life of the thread. The tap should have zero front rake to prevent hogging. Tapping speeds of about half those used for metal—about 110 rpm—are recommended. Large internal threads can be made with a boring bar operating at speeds up to 685 rpm.

Large-diameter internal and external threads can also be made in polystyrene by providing a high-speed steel cutter, ground with a cutting edge shaped to produce the desired thread, on thread-milling or grinding setups. Two operating speeds are involved in this operation. For a 1-inch cutter, speeds of 15,000 rpm or less are usually satisfactory although, with sufficient coolant, speeds to 20,000 rpm can be used. Workpiece rotational speeds vary between 100 and 600 rpm depending on the thickness of the piece. Solid materials can usually be handled at 600 rpm while hollow pieces are run more slowly. For internal threading operations, it is usually safer to use slower workpiece rotational speeds.

Threading of cross-linked polystyrene can be done with a single-point tool using light feeds and an ample amount of oil. Threading can be done on automatic screw machines with the same types of taps and dies as are used on brass. However, a negative rake should be ground on the first several threads of the die or tap. Also, taps should be oversize. This can be accomplished by having them chrome plated. Self-opening dies can be used for external threads. Roots and crests of threads

Photo courtesy Cadillac Plastic & Chemical Co.

Fig. 6. Large holes can be drilled in nylon if drills are kept sharp and have the proper geometry.

should be rounded if possible.

A typical single-point tool for threading cross-linked polystyrene should have: front clearance of 15-20 deg, side clearance of 2-4 deg and rake of 0 to –2 deg. Threading speeds can be about 40 fpm.

Nylon, like other plastics, is notch sensitive. Therefore, a thread with a rounded root, such as a Whitworth thread, should be used for maximum part strength. High-speed steel tools give the best results. Self-opening dies, with high-speed steel chasers, can be used for threading. Taps, chromium plated and 0.002 to 0.005 inch oversize, are required for accurately tapped holes, unless threads are to be self-locking.

As a rule, spindle speeds for threading and tapping nylon are below those for drilling and turning; if not, the first few threads may tear. The tendency to tear can further be lessened by chamfering the hole before tapping and by providing positive feed for the first few threads.

Threads may also be cut with a single-point tool. With single-point tools, the depth of cut per pass should range between 0.007 and 0.010 inch for quality work.

Fluorocarbons can be tapped and threaded in much the same manner and with the same limitations as nylon. Lubricants or coolants can be used but are not always necessary. When threading long lengths of fluorocarbon rod stock, a follow rest or some equivalent support is required to prevent work from slipping away from the tool.

Phenolic casting resins should be tapped with ground high-speed steel taps although regular taps can be used on small runs. Dry tapping is preferred. Self-opening dies with high-speed steel chasers, which extend out in front and have less chamfer than standard chasers, are the most suitable for cutting external threads.

For long production runs with molded phenolic parts, a high-speed, chrome-plated tap having three rather than four flutes is recommended. A negative rake of about –5 deg on the front face of the land and ample clearance are necessary to insure accurate cutting, and to prevent binding and chipping when backing out. Because of the abrasiveness of some fillers, taps 0.002 to 0.005 inch oversize are recommended. They will produce more holes within acceptable tolerances. Holes should be drilled to result in 65 to 75 percent of full thread.

Peripheral speeds for tapping molded phenolics are from 50 to 80 sfpm for taps up to ¼ inch in diameter. Larger taps are impractical in phenolic parts. It is also important to countersink the holes larger than the diameter of the tap to prevent chipping around the threaded hole.

All grades of laminated and reinforced plastics can be tapped, *Fig.* 8, and threaded with high-speed steel tools. However, thread inserts should be considered if threads are liable to frequent use. When threads are cut in laminates, they should not be specified closer than a Class 2 fit with 65 to 75 percent of full thread. Additional thread depth would add little strength while introducing the risk of thread breakage. Threading and tapping can be done dry but cleaner threads usually result if cutting fluids are used. Self-opening die heads and collapsible taps are used on long runs of large-diameter threads.

Tapping of large holes parallel to the laminations should be avoided because the mating thread may cause delamination. If large threads must be tapped parallel to laminations, parts should be clamped in the same way as for drilling. A clearance of two or three times the thread pitch should be left at the bottom of a blind hole. Otherwise, either the threads may be stripped or slight delamination may occur during use. Because punches holes are rough, they should be shaved or reamed before tapping. If this is not done, the ends of the threads will be rough and the mating thread may not fit properly. A slight chamfer around the edge of the hole to be tapped or on the outside of the diameter to be threaded will improve the class of work.

When threading on a lathe, fine cuts should be taken at high speeds. For threaded holes over ½ inch in diameter, it is often desirable to use a motor-driven cutter mounted on the tool post of a lathe. The tool is ground to cut on one side only.

Drawing courtesy Durez Plastics Div.

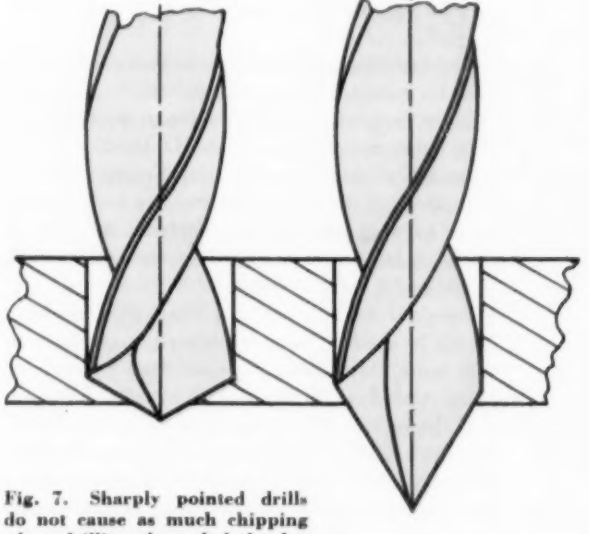


Fig. 7. Sharply pointed drills do not cause as much chipping when drilling through holes because they require less feed pressure and leave less workpiece material near the end of the stroke.

Photo courtesy Westinghouse Electric Corp.

Fig. 8. A standard drill press and tapping head are combined to tap a laminated plastic part.

When cutting a 60-deg thread, it is advisable to swing the compound rest on the lathe to a 30-deg angle. For all other threads, standard methods are used with satisfactory results.

High-speed steel taps should be 0.002 to 0.005 inch oversize. The tap drill should also be 0.002 inch oversize to neutralize the tendency of drills to cut undersize in laminates. Taps should be ground with rakes from 0 to −10 deg. On some reinforced plastics, such as glass-reinforced epoxy resins, 2-flute taps give best results. Speeds and feeds in all tapping or threading operations on laminates are similar to those used with soft steel or brass.

Planing and Shaping: In general, plastics can be planed with standard tools, and at speeds and feeds corresponding to those used with bronze or soft steel. Better results will occur if tools are ground with a slight rake. When possible, full depth of material should be removed in one cut to reduce heat build-up. Rigid vinyl sheet stock can be planed readily with a slow stroke and a side feed. The depth of cut, however, should not exceed 0.25 inch. The planing tool should have about 50 percent more front and side clearances than those used for planing carbon steel.

When shaping laminated gear stock, a speed between 100 and 130 spm is recommended. Feed should be fine unless both roughing and finishing cuts are to be taken. In such cases, the usual 0.010 inch of stock left for finishing may be removed at any feed or speed. As when drilling, a backup plate should be used to prevent delamination.

Glass-reinforced epoxy resins can be shaped, *Fig.* 9, in much the same way as cast iron. A fairly slow stroke is used and, when taking a through cut, stock is first removed from both edges and then from the middle. Shaping can result in a better surface on polystyrene than is obtainable by production milling because tool lines are not left on the work. Styrene is best shaped with tungsten-base high-speed steel bits. Such tools are run dry at a speed of 42 spm.

Broaching: Asbestos, glass and graphite laminates can be broached with standard broaches having approximately 4-deg cutting clearance and a slight positive rake. Except for this clearance angle, the broach is the same as those used for brass. Although broaches will produce holes of any desired shape, the laminated structure means that special broaching procedures are needed. When cutting across the laminations, the material must be backed up by a mild steel or brass plate that forms a slide fit with the last cutting tooth on the broach. This plate prevents fraying and breaking out of the edges. When cuts are taken parallel with the laminations, fixtures should be used to apply pressure at right angles to the laminations.

Photo courtesy Minnesota Mining & Mfg. Co.

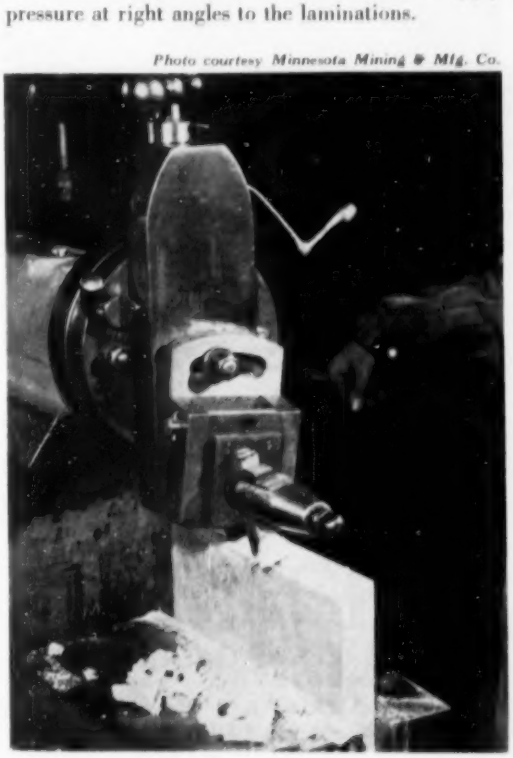


Fig. 9. Glass-reinforced plastics can be shaped easily on standard machine tools.

Teeth of the broach should be so spaced that, except for the beginning and end of the cut, at least two teeth will be in contact with the material all the time. Ample chip room should be allowed between the teeth. The proper amount is determined by the depth of cut per tooth and the length of stroke.

Tapered pilot pins as large as possible will facilitate operations. To prevent the material from splitting out when cutting starts, the workpiece should be backed up with flat washers of the same internal size as the maximum pilot diameter. Depending on the laminate grade and the type of operation, a cut of 0.001 to 0.005 inch per tooth can be taken. The pitch can range from $\frac{1}{4}$ to $\frac{3}{4}$ inch, and broach speeds vary from 30 to 50 fpm.

Routing and Rotary Shaping: Both of these processes have been successfully applied to the production of plastic parts. High spindle speeds are always used and, for long runs, carbide-tipped cutters are economical. Rotary shaping of acrylics is done to form rabbetted edges for flush mounting, to achieve predetermined cross sections and to obtain correct size for both flat and formed parts.

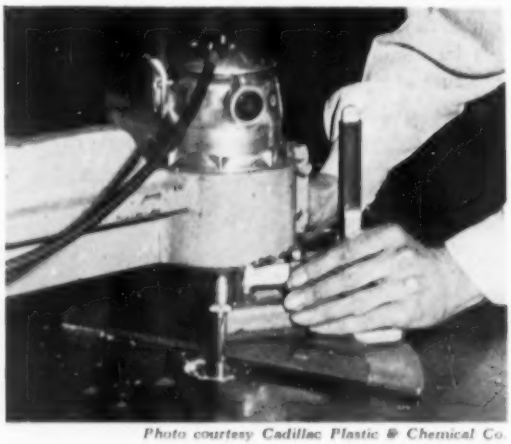


Photo courtesy Cadillac Plastic & Chemical Co.

Fig. 10. Finished edges can be easily produced on acrylic parts by routing.

Since the smoothness of a routed edge depends on the peripheral speed of the cutter, routers for use on plastics should have no-load spindle speeds of 10,000 to 22,000 rpm. At such speeds, two or three-flute cutters under $1\frac{1}{2}$ inches in diameter will give satisfactory results on acrylics. Larger cutters with more flutes can give equivalent results at lower speeds.

Cutters should be sharp and should have a back clearance angle of about 10 deg, but without rake. When cutting rabbets on a router, it is desirable to grind a slight radius on the corner of the cutter so that it will produce a fillet in the shoulder of the rabbet. Unless this precaution is taken, the sharp corner may cause the part to fail in use. When preparing the edge of a part, *Fig.* 10, this radius is unnecessary.

Work should be fed to the cutter slowly and continuously to reduce cracking and to avoid overheating. It is advisable to use either an air blast or a suction system to remove chips and cool the cutter. Because of thickness variations in cast acrylic sheet, it is not possible to maintain close tolerances in both toe and depth of rout. Relatively small tolerances can be maintained on either the toe or depth but when the tolerances of both are critical, a second routing operation is required. Tolerances of $\pm$ 0.015 inch can be maintained in depth or toe of rout in a single operation. The length of shoulder of a rout can be held to tolerances of about $\pm$ 0.030 inch. Standard high-speed end mills can also be used for rabbetting acrylics. When it is desired to obtain a right-angle edge on a large formed piece, a portable router can be used for trimming.

As with the machining of metals, experience gained in one type of machining operation can be used as the starting point when attempting another type of operation. It has been the purpose of this series of articles to provide starting points for a number of machining operations on a variety of plastics. More specific information could not be given because the number of combinations of plastic formulations and machining operations is infinite. However, because of the overheating and gumming characteristics of plastics, when machining processes are incorrectly tooled up, this fact is immediately apparent. The necessary adjustments can be determined quickly by trial and error.

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Metal Finishing

with abrasive belts

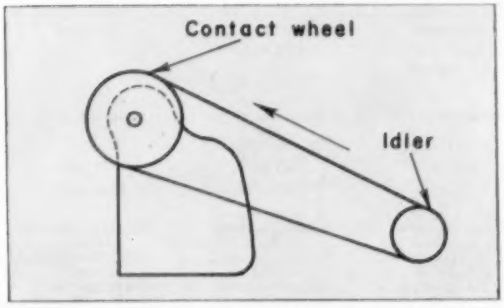
Abrasive belts are used for roughing, polishing, and "oiling out" or finishing of both ferrous and nonferrous metals. Successful offhand metal removal with abrasive belts is dependent upon using the correct belt-and-contact-wheel combination and correct speed for each application.

Belt Selection: Two types of grit are used in abrasive belts for metal-removal operations: aluminum oxide and silicon carbide. These are available in a wide range of grit sizes to fit specific needs. Aluminum oxide is recommended for rough-finishing steels, brass, bronze, copper and cast iron. Silicon carbide is preferred for roughing aluminum. For polishing, aluminum oxide is preferred for all materials except stainless steel, which is best polished with silicon carbide. Silicon carbide produces a finer finish than aluminum oxide when oiling out or finishing nonferrous metals. Aluminum oxide is recommended for oiling out and finishing steel and cast iron. Grit sizes range from 24-60, used for roughing, to 180-500 for finishing.

Stiff belts are best for flat work. The use of flexible belts is largely confined to contour work. Abrasive belts are most often used dry; however, special belts are available for use with oil or grease, giving long belt life and superior finish.

Table 1—Roughing

	Steel and Stainless Steel (cold and hot rolled)	Aluminum (cast and fabricated)	Brass, Bronze and Copper	Cast Iron
Abrasive	Aluminum oxide	Silicon carbide	Aluminum oxide or Silicon carbide	Aluminum oxide
Grit Size	24-60	36-50	36-50	36-60
Belt Speed (sfpm)	4500-6500	5500-7000	5500-7000	4500-5500
Contact Wheel	Rubber (serrated) 70-90 Durometer	Rubber (serrated) 70-90 Durometer	Rubber (serrated) 70-90 Durometer	Rubber (serrated) 70-90 Durometer



For best results in belt finishing, idler should be below contact wheel.

Contact Wheel Selection: Contact wheels are available in both rubber and cloth. They have been classified into six general types.

PLAIN FACE RUBBER WHEELS are used for intermediate and final finishing and also for oiling. They are suitable for fining brass, bronze and copper and for oiling and polishing aluminum and steel workpieces and zinc die castings. Wheel hardnesses range from 20 to 100 Durometer.

SERRATED FACE RUBBER WHEELS are molded with an "X" pattern in their faces. Their advantages over plain face rubber wheels are a faster cutting action and long belt life. They are used for stock removal, rough grinding and intermediate polishing. Typical operations are snagging gates and cutting out pits and sur-

Data furnished by Behr-Manning Co., a Div. of Norton Co., Troy, N. Y.

face defects of all metals. Wheel hardnesses are the same as for plain face rubber wheels.

COMPRESSED CANVAS WHEELS come in many hardnesses from very hard to "supersoft" and are used for polishing both ferrous and nonferrous metals. Like rubber wheels, they can be used for snagging, giving a less aggressive cut than rubber. When used for intermediate polishing and finishing work, the softer types of wheels produce finer finishes than harder types. Life of compressed canvas wheels is excellent and they can be shaped for contour work.

SOLID SECTION WHEELS, available in soft, medium and hard densities, are made in definite wheel widths. Unlike wheels made up of individual sections, they have uniform density and will give a cut of uniform depth across the entire face of the wheel. These wheels are low in cost and adjust themselves easily to contours. They are used for all types of belt finishing except snagging.

BUFF SECTION WHEELS are usually soft. They are made up of individual sections, hence can readily be made wider or narrower by adding or removing sections. All types of work except snagging can be performed with this type of wheel, which is especially suitable for contour polishing. Wheel cost is low.

FINGER TYPE WHEELS are intended for polishing and finishing operations only. These wheels are soft and can be used for polishing contours and flats, giving uniform cut and finish.

Belt Speeds: Even when a suitable contact wheel is used, poor finishes result when belt speeds are incorrect. Excessive speeds have the effect of making soft contour wheels harder. As a general rule, snagging and roughing operations should be carried out at 4500-5500 sfpm. Polishing and oiling speeds should be within a range of 6000-6500 sfpm. Speeds exceeding 7000 sfpm are detrimental to good belt life.

Backstand Installation: Best results are obtained in belt finishing when the idler is positioned close to the floor, as shown in the accompanying illustration. The belt is fed onto the wheel on the side away from the operator, well ahead of the point where the workpiece contacts the belt. This minimizes the possibility of the belt untracking when pressure is applied to the wheel and is particularly important when working with soft wheels.

General specifications for the roughing, polishing, oiling and finishing of all metals are given in the accompanying tables. The types of belts for various applications are also listed, as well as grit sizes, surface speeds and contact wheel types.

Table 2—Polishing

	Steel and Stainless Steel (cold and hot rolled)	Diecastings	Aluminum (cast and fabricated)	Brass, Bronze and Copper	Cast Iron
Abrasive	Aluminum oxide (Silicon carbide for stainless)	Aluminum oxide*	Aluminum oxide or Silicon carbide	Aluminum oxide or Silicon carbide	Aluminum oxide
Grit Size	80-180	60-150	50-150	60-150	36-150
Belt Speed (sfpm)	4500-7000	5500-7000	4500-7000	4500-7000	4500-6500
Contact Wheel	Rubber (serrated or plain) 20-50 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated or plain) 30-70 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated or plain) 30-70 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated or plain) 30-70 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated) 30-70 Durometer, sectional or finger type cloth wheel, or free belt

*Use silicon carbide for zinc.

Table 3—Oiling Out or Finishing

	Steel and Stainless Steel (cold and hot rolled)	Diecastings	Aluminum (cast and fabricated)	Brass, Bronze and Copper	Cast Iron
Abrasive	Aluminum oxide	Aluminum oxide*	Aluminum oxide or Silicon carbide	Aluminum oxide or Silicon carbide	Aluminum oxide
Grit Size	180-500	180-500	180-320	180-240	120-240
Belt Speed (sfpm)	4500-7000	5500-7000	4500-7000	4500-7000	4500-7000
Contact Wheel	Rubber (serrated or plain) 20-30 Durometer, sectional or finger type cloth wheel, covered platen, or free belt	Rubber (serrated or plain) 30-70 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated or plain) 30-70 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated or plain) 30-70 Durometer, sectional or finger type cloth wheel, or free belt	Rubber (serrated or plain) 30-50 Durometer, sectional or finger type cloth wheel, or free belt

*Use silicon carbide for zinc.

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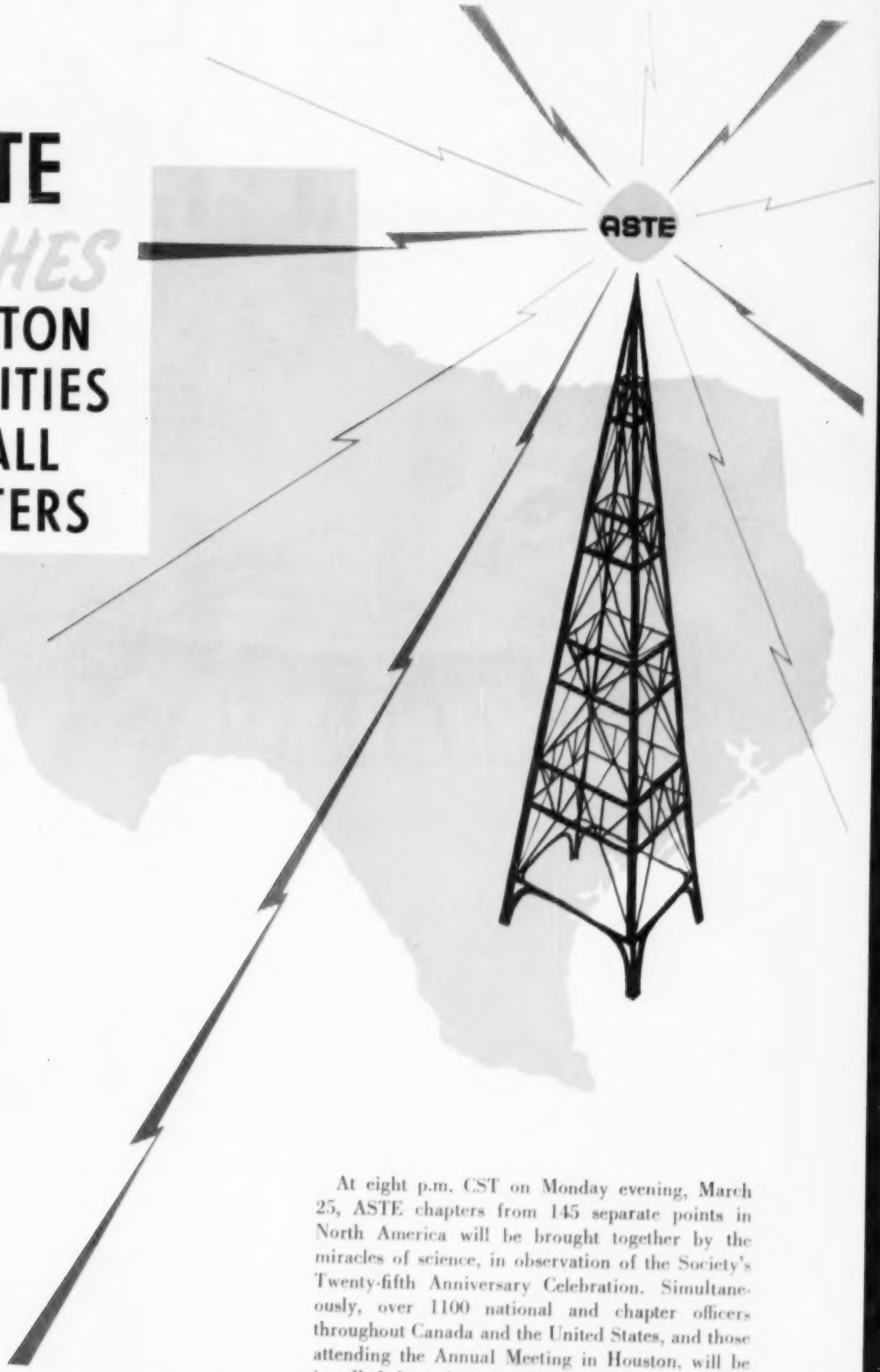
ASTE FLASHES

HOUSTON FESTIVITIES TO ALL CHAPTERS



At eight p.m. CST on Monday evening, March 25, ASTE chapters from 145 separate points in North America will be brought together by the miracles of science, in observation of the Society's Twenty-fifth Anniversary Celebration. Simultaneously, over 1100 national and chapter officers throughout Canada and the United States, and those attending the Annual Meeting in Houston, will be installed through the medium of a close-circuit audio broadcast. This coast-to-coast hook-up is the most extensive closed-circuit broadcast ever to be undertaken. It is appropriate that science itself

aste closed circuit

should serve to commemorate the productive and successful first quarter-century of ASTE's own contributions to science.

During the 50-minute broadcast from the center of activities in the Emerald Room of Houston's Shamrock-Hilton Hotel, there will be a salute to each individual chapter; a recounting of the history and growth of the Society; and salutations and congratulations from leaders in industry, government, education, business, and the American people.

The plan to use a closed-circuit broadcasting system to disperse anniversary proceedings was evolved in order to allow all ASTE members to participate in the Silver Anniversary activities, even though they might not be able to attend the Houston festivities in person. It will also provide an opportunity for each chapter to hold its own Silver Anniversary celebration and still participate in the national commemoration.

Individual chapters are now planning their March programs around the broadcast night. In many cases, members' wives will be invited to the ceremonies. Nontechnical programs—some involving dinner and dancing—have been scheduled. However, each chapter is free to formulate its own plans for the balance of the evening. In a few groups, where unalterable plans have been made to hold the March meeting on another night, chapter officers will schedule a second March meeting on the night of the twenty-fifth. It is possible also for the program to be piped into homes where the celebration is going on.

Where chapter chairmen plan to attend the Annual Meeting in Houston, other officers or past presidents will preside over the meeting and installation of new officers. All officers will be installed simultaneously, whether in Houston or at the home chapter, by means of the broadcast.

The program will be heard on the East Coast an hour later, at 9 p.m., due to the difference in time zones, while a delayed broadcast will be arranged to make the program fall at a more convenient time on the West Coast.

The enthusiastic wave of response from the chapters has indicated this extraordinary event will strengthen the bond of fraternal friendship and cooperation which has been responsible for the ASTE's tremendous growth in the short span of its existence. It is hoped that each and every one of the chapters across the continent will be able to participate in this significant milestone in their Society's history.

project VANGUARD

launching the first space satellite

"Project Vanguard—Launching the Man-Made Moon" is the title of Mahlon A. Winter's paper which will make up the first part of ASTE's "Engineering Behind an Earth Satellite Launching" session at the Houston meeting.

This session will be sponsored by the Martin Co., Baltimore, prime contractors of the U.S. Government on "Operation Vanguard."

Amazing research, advanced scientific studies, and millions of dollars have been spent to launch a four-pound magnesium satellite to circle the earth.

Up to the present time, high altitude research has been conducted by using rockets, which when fired straight up, complete their flights in a matter of minutes. The importance of the satellite project lies in that the satellite will remain aloft for a relatively long period of time, during which extensive scientific observations will be made.

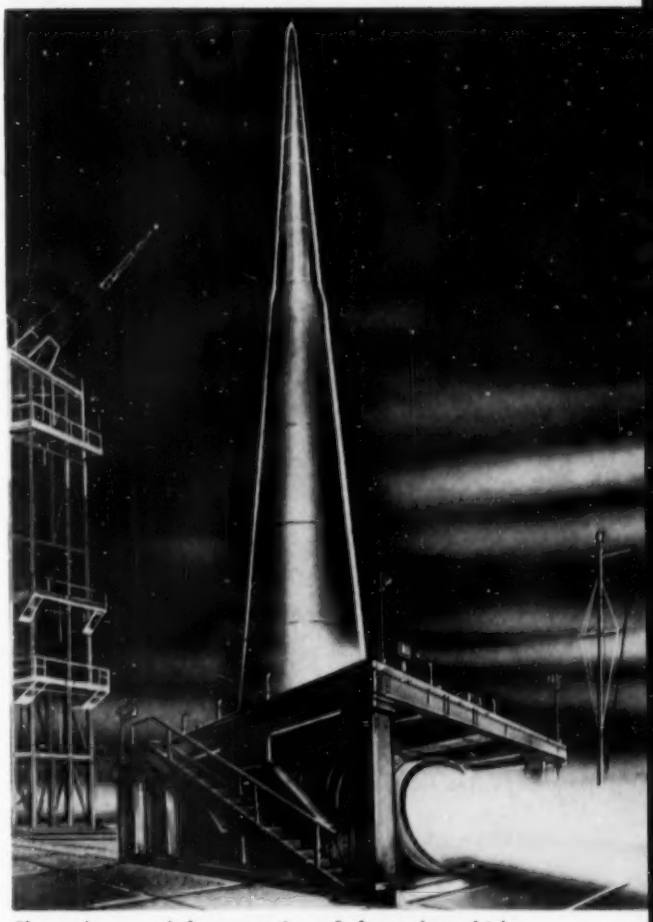
The magnesium "man-made moon" will be projected by 11 tons of rocket and equipment on its 18,000 mile per hour journey through space.

About the size of a beach ball, a scant thirty thousandths of an inch thick, this "moon" is made of magnesium, the lightest structural metal, whose weight is only one-fourth that of steel and two-thirds that of aluminum. While the total weight of the complete satellite is about 22 pounds, only 4 pounds of the weight is in the magnesium parts.

The accelerating rocket with its satellite penetrates atmosphere of decreasing density until, moving at extremely high speeds 200 miles above the earth, it is traveling in an almost perfect vacuum.

The second part of ASTE's "Engineering Behind Earth Satellite Launching" will be a paper entitled "Tool Engineering for Project Vanguard" by Raymond G. Sipe, tool project engineer of Project Vanguard, the Martin Co.

In addition, a colored movie "Horizon Unlimited" will be shown.



Shown is an artist's conception of the rocket which will place the world's first man-made satellite in its orbit around the earth.

Finish-turning cut is made with ceramic tool on cold-drawn mechanical seamless steel tubing.

symposia

cover tooling techniques

Latest research developments on ceramic tools, and their adaptability to production problems, will be featured at ASTE's Silver Anniversary Meeting in Houston.

Ceramic Tool Symposium

This symposium, under the sponsorship of MIT, Ohio State University and the Warner & Swasey Co. of Cleveland, Ohio, will include the reading of nine papers, later to be made available in book form.

The Warner & Swasey Co. will feature an exhibit of ceramic tools and specially adapted equipment, which will be at the disposal of schools, companies and other public groups at the conclusion of the symposium.

Many practical advantages are offered by ceramic cutting tools in that they maintain their hardness under extremely high temperatures, they exhibit a low coefficient of friction, and the basic materials for their production are readily available in large quantities. When certain disadvantages are overcome, unlimited possibilities for the use of ceramic cutting tools appear likely. Many of the laboratory applications which have been unusually successful, will be demonstrated during the conference.

While searching for substitutions for strategic materials, the U. S. Army Ordnance during World War II conducted some of the earliest successful experiments in ceramic tooling.

A progress report of English industries' advances in the field of ceramic tools was brought to this country several years ago by ASTE's national vice president H. E. Collins, who recognized the potential value in ceramics.

Experimental studies in ceramic tooling by industries and universities have been developed over the past 25 years in both Europe and the United States.

Plastic Tooling Symposium

For the first time, a composite textbook on plastic tooling will be generally available as a result of ASTE's Plastic Tooling Symposium to be held at the March Silver Anniversary Meeting.

Cosponsored by the Society of Plastics Industry, the symposium will report the latest developments in the practical applications of plastic tools to production.

Papers to be delivered, comprising the most complete report on plastic tooling to date, will be later bound together in a single volume.

Nine technical papers by experts in the field will be presented at the five special sessions on plastic tooling.

Among the subjects to be covered are: the history of plastic tooling, properties of plastics, advantages and disadvantages of plastic tools, and their effect on tooling expense.

Other highlights of the convention will include information from the plastic tooling research project currently being conducted at Purdue University under the auspices of ASTE's Research Fund Committee.

Workmen are shown constructing huge plastic die, used for stamping the roof of an automobile.

symposia papers previewed

Some forty-seven technical speakers will present forty-two papers in the technical conferences at the annual convention in March. Previews of papers authored by speakers connected with the Ceramic Tool Symposium and the Plastic Tooling Symposium will appear in this issue, together with brief biographies of the authors. Outlines of papers prepared for other technical conferences will be published in the March issue.

Early interest in ceramic tools in this country was generated from reports of their use in Europe.

Ceramic Papers

Nathan H. Cook, assistant professor of mechanical engineering at MIT, in his *Review of Published Russian Work,* has researched Russian literature on ceramic tools, to be able to paint a picture of developments in that country. Since they have been working with ceramics longer, the Russians have applied them more to production operations, some of which the author describes in detail.

A second paper by Mr. Cook investigates *Cutting Tool Temperatures,* important in ceramic tools because of the effect high temperature gradients have on the relative softness or brittleness of the material. Through both analysis and comparison, the temperature of the tool tip has been found noticeably higher in ceramics than in tungsten carbide tools, due primarily to the low conductivity of ceramics.

Although ceramic cutting tools have only recently received widespread attention, they were proposed as possible metal-cutting tools over half a century ago. **Dr. Robert F. Rea,** production engineering manager of Stupakoff Div., Carborundum Co., in his *Background and Properties of Oxide Cutting Tools,* traces the history of ceramic tools and describes the various physical properties of the tool materials now commercially available.

Cook

Rea

NATHAN H. COOK, assistant professor of mechanical engineering at Massachusetts Institute of Technology, received his Sc.D. degree from that institution in 1955. He has been associated with the metal-cutting laboratory of MIT's mechanical engineering department since 1949.

ROBERT F. REA, research director at Stupakoff Ceramic and Mfg. Co., was one of the early graduates in ceramic engineering at Ohio State. Holder of a fellowship from the Edward Orton Jr. Ceramic Foundation, he received his Ph. D. in ceramic engineering in 1937. Early experience was gained as petrographer for Battelle Memorial Institute and as refractory research engineer for Denver Fire Clay Co. Later, with Midland Refractories, and its parent, Zonolite Co., he helped develop industrial applications for vermiculite.

An Analysis of Variables in Ceramic Tool Cutting is coauthored by **Donald R. Kibbey** and **Dr. W. T. Morris,** both professors at Ohio State University. This paper points the way for the solution to the problem of finding optimum operating conditions for ceramic tool materials, using the "analysis of variables" design. This method, known to

ceramic tools

researchers in other fields, studies variables in groups rather than one at a time, and permits detection of any important interaction effects among the variables tested. The method can prove of value in testing procedures concerned with other production problems, and need not be confined to the field of metal removal.

Ceramic Tool Geometry and Preparation, prepared jointly by **Mr. Kibbey** and **Harry D. Moore** of Ohio State's industrial engineering department, is based on a carefully thought out testing program, in which several factors for which values were desired were varied in each test. Indicating the care with which ceramic tools should be prepared and the critical nature of their physical geometry, they quickly determine areas in which ceramic tools can be used successfully and areas where they should not be used. While describing successful application of ceramic cutting tools to regular production operations, coauthors **A. O. Haeme** and **R. T. Hook** of Warner & Swasey Co. point out how suitable operations can be selected. In their paper titled *Industrial Application of Ceramic Tools* they voice their feeling that current ceramic tools represent neither a panacea to all cutting problems nor the ultimate development in ceramic tool materials.

E. W. Engle, technical director of Vascoloy-Ramet Corp., and **G. W. Barnes,** sales engineer

Kibbey

Hook

Morris

Moore

Haeme

DONALD R. KIBBEY, instructor in Ohio State University's industrial engineering department is also chief investigator for sponsored research in the use of ceramic tool materials on the campus. An Ohio State graduate, holding both a bachelor's degree in mechanical engineering and a master's degree, he has had two years of design engineering experience with the Monarch Machine Tool Co. of Sidney, Ohio.

W. T. MORRIS, assistant professor of industrial engineering at Ohio State University, is in charge of plant design and materials handling courses there, and also teaches basic statistical methods. Holder of both an M.S. and a Ph. D. from Ohio State, he has been a member of that school's Operations Research Group since 1954, and has written a book on decision theory. Formerly market analyst with American Brake Shoe Co., he was also research and development officer in the U.S. Air Force for three years.

A. O. HAEME has worked in various capacities at Warner & Swasey Co. of Cleveland for 20 years. Prior to taking the four-year apprentice course with his company, he studied at Fenn College and John Huntington Polytechnical School. After holding various supervisory jobs in the carbide department, he was made assistant tool superintendent in 1953, and tool superintendent in 1956. He is a member of ASTE's Cleveland chapter.

R. T. HOOK was appointed chief metallurgist of Warner & Swasey in 1953. A graduate of Case Institute of Technology in metallurgical engineering, he served as Director of Intelligence with the 8th Air Force in Europe during World War II. A registered professional engineer, he is also chairman of the Warner & Swasey Metal-Cutting Committee, and active in ASM, serving on its educational committee. He is a member of ASTE's Cemented Borides Steering Committee and of ASA's Technical Committee on Single Point Turning.

HARRY D. MOORE, associate professor of Ohio State University's industrial engineering department, has supervised the school's sponsored research on ceramic tool materials. Formerly project engineer with the Columbus McKinnon Chain Corp. in Tonawanda, N. Y., and a registered professional engineer, he holds both a bachelor's degree in mechanical engineering and an M.S. degree. Besides university teaching, he has given courses in manufacturing plants and conducted research in the machine tool field.

for New Products Div., Norton Co., have pooled their experience in the paper *Ceramic Tools—the Challenge of Physical Properties.* The authors approach their subject from the point of view of physical properties because for many years ceramics have been considered rather fragile materials. Also, as a direct result of these properties, the design of the toolholders is critical. Investigation to date shows that ceramic tips should be held in such a way as to stress the material in compression rather than intention. Information is also included on early results of field testing a commercially available ceramic tool material.

Professors **Milton C. Shaw** and **Prescott A. Smith,** of MIT's mechanical engineering department, have collaborated on a paper entitled *A Comparison of Workpiece Finishes Produced by Ceramic and Carbide Tools.* The authors describe the sources of surface roughness resulting from machining operations. After summarizing comparison tests, they point out those operating conditions under which ceramic tools give the best surface finishes and regions of operations where carbides give the best results.

The method of controlled introduction of ceramic cutting tools to standard production operations is described by **Joseph F. Allen,** factory manager of Cameron Iron Works, Inc., Houston, in his *Progress Report—Ceramic Tools Applied to Production Jobs.* With this approach, results obtainable with ceramics can be directly compared to those obtained with carbides, to determine on which kinds of operations each type of tool is most suitable. This paper is especially interesting since the author has described applications that proved to be failures as well as those that were successful.

Barnes

Smith

Shaw

Allen

Engle

G. W. BARNES, a 1946 graduate of Purdue University's mechanical engineering school, is sales engineer for the New Products Div. of the Norton Co. He completed the graduate course of Westinghouse Electric's manufacturing school, and was with that company till 1949. He was an industrial engineer for Cluett Peabody and Co. and did product and tooling design for the Independent Lock Co. before joining the Norton Co.

MILTON C. SHAW, professor of mechanical engineering and head of the Machine Tool Division, Massachusetts Institute of Technology, received his undergraduate training at Drexel Institute of Technology and a Sc.D. degree in chemistry and physics at the University of Cincinnati. In addition to working in the Cincinnati Milling Machine Co.'s experimental laboratories, he was chief of the materials branch of the National Advisory Committee for Aeronautics.

E. W. ENGLE, a 1941 graduate of Massachusetts Institute of Technology, had fifteen years of experience with Metallurgical Products Div. of General Electric Co. before joining Vascoloy-Ramet Corp., of which he is now technical director. Mr. Engle is an active participant in ASTE, AIME, ASM, ASTM, and AOA.

PRESCOTT A. SMITH is a graduate of Massachusetts Institute of Technology's mechanical engineering school, and has ten years of manufacturing experience behind him, having worked as equipment engineer, methods engineer, plant engineer, tool engineer and factory manager. Associate professor of mechanical engineering in charge of MIT's machine tool laboratory, he is also a past member of the ASTE National Education Committee and a past chairman of the Boston ASTE chapter.

JOSEPH F. ALLEN, factory manager of Camerón Iron Works, Inc., Houston, gained early experience with Warner & Swasey Co. His work there culminated in a two-and-a-half-year program of carbide cutting research, the outgrowth of a nationwide survey he conducted. His work formed the basis for a program of new tool design. He has also worked with the Naval Ordnance Lab in Washington, helping to design underwater ordnance components. He is a registered professional engineer.

plastic tooling

The History of Plastic Tooling by **Appy Juras,** consultant for the Bakelite Co., covers early experiments with materials and techniques, their deficiencies and the means of overcoming them as developed by the early pioneers of the industry. It will include present trends in materials and methods along with research efforts being made to increase the scope and knowledge of the plastic tooling field.

V. V. Lindgren, technical director of the American Cyanamid Co. poses the question *What Are Plastics?* Because there is an infinite variety of families of plastics, the author attempts to indicate where the various types should be used as tool materials. He describes the characteristics of plastics that are advantageous and those that are disadvantageous, so that each class of materials can be used intelligently.

Rather than dwell on methods of preparing tools or using them, **Lewis W. Bogart,** sales engineer with Tool Chemical Co. of Detroit, gives in his *Tool Applications of Plastic Materials*, an over-all picture of the uses to which plastic tools are currently put. Such tools include holding fixtures, locating fixtures, inspection fixtures, etc.

The Fabrication of Plastic Tools, by **Lloyd J. Oye,** marketing director of Rezolin, Inc., deals with the major factors of how to select and apply plastic tooling materials for optimum results. The basic methods of making plastic tools are discussed, as well as numerous specialized techniques that have been developed over a period of years. All points are illustrated with the aid of photographs and diagrams of actual applications.

Inasmuch as there are practically an unlimited number of combinations of the several components that make up particular tooling plastic formulations, **John Delmonte,** of Furane Plastics, Inc.,

Bogart

Delmonte

Arrufat

Rice

LEWIS F. BOGART, sales engineer for Tool Chemical Co. of Detroit, is a 1951 University of Detroit graduate in mechanical engineering. He completed a cooperative course with Chrysler Corp., during which time he was assigned to many of their development labs. After a year with Design Service Co., Detroit, he entered the plastic tooling field, and has since been engaged by The Marbiette Corp., Long Island, to sell and service users of plastic tooling materials.

WALTER J. ARRUFAT, associate engineer in IBM's tool engineering department, has had 18 years of tooling experience with that firm. During that time he has given several seminars on plastic tooling for company employees in Endicott, Poughkeepsie, and Kingston. He has also taught toolmakers' shop mathematics and factory workers' shop subjects. A member of ASTE's Binghamton chapter, he is also on the Steering Committee on Plastic Tooling for the Society's Research Fund. He is now investigating low-cost tooling for IBM.

JOHN DELMONTE, president of Furane Plastics, Inc., of Los Angeles, graduated from New York University's college of engineering, and received his M.S. degree from Massachusetts Institute of Technology. His technical experience includes work as assistant engineer for the Sunbeam Electric Co. and technical director of Plastics I. T. Institute. The author of three books covering the fields of plastics and adhesives, he is affiliated with SPE, SPI, ASTM and ACS.

GEORGE M. RICE had 18 years of experience with Ford and Lincoln-Mercury before becoming sales manager for Renaud and Ren Plastics, Inc., Detroit, in 1953. He frequently spoke on new ideas and methods before technical organizations, including ASA's New York group. After attending Wayne University, Walsh Institute of Accounting, and Dearborn General College, he gained practical knowledge of the electrical field with Electromaster, Inc. In his present position he counsels on the use of plastics in mass production and directs the marketing of Ren plastic.

describes the methods by which specific properties can be achieved. He shows the interrelationship between quality control raw materials, effective formulation procedures, and precise control of temperatures and quantities, and describes the functions of the various components, in his paper on *Control of Physical Properties.*

In addition to describing the ease with which plastic tools can be modified or repaired, **Benjamin Sokol's** *The Repair of Plastic Tools* covers a good many of the causes of damage to plastic tools, and indicates operating procedures by which such damage can be minimized. The author, who is connected with Republic Aviation Corp., looks at the "economic" and "urgency" aspects of plastic tool repair, weighing the original and replacement cost of the tool against the cost of repair and the relative importance of the part involved.

Elliott Dorman, of Ciba Co., Inc., discusses *What Properties Are Available in Plastics?* His paper defines terms used to describe mechanical, chemical and electrical properties of engineering plastics materials. Because a wide range of properties is available among the various plastic families, and among various formulations within a single family, the author describes the influence of the various components available to the plastics compounder.

In his paper covering *Plastic Tooling for Small Parts,* **Walter J. Arrufat,** of IBM Corp., presents concise and clear descriptions of the various techniques used to construct plastic tools. In addition, he indicates the high utility of plastic tools even for the production of small parts. His discussion is extremely well illustrated.

The fact that plastic tools can be easily repaired or modified is one of their greatest advantages. The subject area can be cut away and rebuilt, or can be sanded and cleaned by bonding a new surface coat. **George M. Rice,** of Renaud Plastics and Ren Plastics of Lansing, describes these two methods in his paper *Plastic Tools Can Be Modified or Repaired,* and indicates under what conditions which of the methods should be used.

Juras

Lindgren

Oye

Sokol

Dorman

APPY JURAS, consultant with the Bakelite Co., has been associated with the tooling field for 18 years, chiefly in aircraft and automotive design. The past five years he has devoted to plastic tooling. He is currently doing independent consultant work on plastic tooling problems and the development on new materials and methods.

VINCENT V. LINDGREN, technical director of the Plastics and Resins Div. of the American Cyanamid Co., took his undergraduate work at DePauw University, where he graduated in 1941. At Purdue University he took his Ph.D. degree in 1945, and post doctorate work in 1946, before joining his company that same year.

LLOYD J. OYE spent eleven years as field inspector, field engineer, West Coast manager, and manager of field engineering with Magnaflux Corp., before joining Rezolin Inc. Now marketing director for that company, he served in World War II as General Staff Corps Officer after attending the University of Minnesota. He is active in professional socieities, belonging to ASM, ASME, AWS, ASTE, SPI and SNDT.

BENJAMIN SOKOL, supervisor of the Nonmetallic Mfg. Research and Processes Dept. of Republic Aviation Corp., Farmingdale, N. Y., joined the company in 1950. His job deals largely with the design and development of plastic tooling and parts. He had formerly acted as plant manager of Beautiglass Plastics Co. and, later, Lustra-Cite Industries, Inc. Holder of a bachelor's degree in chemical engineering from Yale, he is active in ASTE, SPE, SPI, ASTM, and AICHE.

ELLIOTT N. DORMAN is assistant technical sales manager of the Plastics Div. of Ciba Co., Inc., working with epoxy resins. Prior to joining Ciba, he was sales engineer for Catalin Corp. of America, and concerned with cast phenolics and molding powders. A chemical engineering graduate of Columbia University in 1949, he also attended Syracuse University's College of Applied Science. Active in various technical groups, he has authored several papers and articles on epoxies.

your houston PROGRAM

Of Special Activities Requiring Advance Registration

MARCH 23	SATURDAY	
	6:00 p.m.	Honor Awards Dinner
MARCH 25	MONDAY	
	8:30 a.m.	Tour No. 1. Reed Roller Bit Co. Limit 150 persons.
	1:15 p.m.	Tour No. 2. Oil Well Drilling Rig. No limit.
	5:00 p.m.	Silver Anniversary Social Hour
	6:00 p.m.	Silver Anniversary Dinner
MARCH 26	TUESDAY	
	8:30 a.m.	Tour No. 3. Mission Mfg. Co. Limit 150 persons.
	8:30 a.m.	Tour No. 4. Hughes Tool Co. Limit 40 persons.
	1:15 p.m.	Tour No. 5. Schlumberger Well Surveying Corp. Limit 150 persons.
	2:15 p.m.	Tour No. 6. Hughes Tool Co. Limit 40 persons.
MARCH 27	WEDNESDAY	
	8:30 a.m.	Tour No. 7. Cameron Iron Works, Inc. Limit 150 persons.
	8:30 a.m.	Tour No. 8. Hughes Tool Co. Limit 40 persons.
	1:15 p.m.	Tour No. 9. W-K-M Mfg. Co. Limit 150 persons.
	2:15 p.m.	Tour No. 10. Hughes Tool Co. Limit 40 persons.
MARCH 28	THURSDAY	
	10:00 a.m.-5:30 p.m.	Rodeo and Barbecue [Barbecue entertainment and complete western rodeo compliments of Houston chapter members. Children under 12 years admitted FREE (except for transportation).]

Announcement of the theme of ASTE's Silver Anniversary Technical Meeting and Convention has been released—A Better Life Through Creative Manufacturing. Included in the program will be plastic and ceramic tooling symposia, technical papers and panels. Subjects will range from new advances and rolling techniques to machine tool selection, machining and grinding.

● REGISTER NOW FOR ASTE'S SILVER ANNIVERSARY MEETING AT HOUSTON

Complete the attached form and mail it to ASTE Preregistration, 10700 Puritan, Detroit 38, Mich., enclosing your check or money order in full amount.

NO MAIL RESERVATIONS ACCEPTED AFTER MARCH 15, 1957

NO REFUNDS WILL BE MADE AFTER MARCH 15, 1957

Preregistration Form
Silver Anniversary Meeting

MAIL TO: **AMERICAN SOCIETY OF TOOL ENGINEERS**
25th Annual Meeting
Preregistration Department
10700 Puritan Ave., Detroit 38, Mich.

I wish to preregister for ASTE's Silver Anniversary Meeting. My check (or money order) in the amount of $..... is enclosed covering items indicated below.

[Note: When registering for others, include their names and addresses on an attached sheet.]

No.	Item	Price	Total
	Convention Registration Fee	$2.00	
	Honor Awards Dinner	7.00	
	Silver Anniversary Social Hour	2.00	
	Silver Anniversary Dinner	8.00	
	Plant Tours ($1.00 each) Circle Tour No. 1 2 3 4 5 6 7 8 9 10	1.00	
	Rodeo and Barbecue (transportation not included)	3.00	
	Rodeo and Barbecue for children under 12 years (transportation not included)	no charge	
	Rodeo and Barbecue Transportation	1.50	
	Silver Anniversary Collected Papers* (includes all symposia papers)	5.00†	
	Plastic Symposium Papers*	3.00†	
	Ceramic Symposium Papers*	3.00†	
		Total Remittance	

*Orders to be filled by April 1, 1957.
†Prices shown include 50% discount to members. Full price is charged to nonmembers.

MAIL TO:

Name .....

Mailing Address .....

.....

Note: Hotel room reservations should be sent directly to Shamrock-Hilton Hotel, Houston 1, Texas.

why

Exciting and entertaining week-long activities planned for ASTE wives who accompany their husbands to Houston, March 23-28, 1957.

the ladies will like HOUSTON

SATURDAY, MARCH 23	
2-4 p.m.	Ladies Reception, Shamrock Room
SUNDAY, MARCH 24	
a.m. and p.m.	Ladies Open House, Houston Hospitality Suite
8:30 p.m.	"Romance of Oil," Emerald Room, mixed gathering. Sponsored by the oil industry information committee, this program will include Speaker Lyle L. Payne, assistant vice president of engineering, Hughes Tool Co.; a colored movie, "Evolution of the Oil Industry"; and "The Magic Barrel" act.
MONDAY, MARCH 25	
12-4:30 p.m.	Houston Flower Tour. A tour of Houston's famous azaleas and redbud trees in bloom, beautiful Houston homes, and other points of interest. Transportation, $2.
5 p.m.	Silver Anniversary Social Hour, mixed gathering around the pool. Tickets $2. See order blank on page 141.
6 p.m.	Silver Anniversary Dinner. Dinner and simultaneous installation of over 1100 ASTE national and chapter officers by closed circuit audio broadcast. Tickets $6. See order blank on page 141.
TUESDAY, MARCH 26	
9-4:30 p.m.	Trip to historic San Jacinto Battleground, site of Texas' successful struggle for independence from Mexico. Nearby, the final resting place of the famous battleship "Texas." Seafood luncheon at San Jacinto Inn. Tickets $6.
WEDNESDAY, MARCH 27	
9-4:30 p.m.	Houston shopping, a western style show, luncheon at a leading store, more shopping, and trips to world's largest suburban shopping center, Gulfgate. Transportation, luncheon, $5.
THURSDAY, MARCH 28	
10-5:30 p.m.	Rodeo and barbecue, mixed gathering.

Muskegon Initiates Student Industry Day

December 11 marked the date of Muskegon chapter's Student Industry Day, when 240 senior students from four local high schools attended plant tour sessions and discussion panels, and were dinner guests of the local industrial managements.

The students, representing Muskegon High School, Muskegon Heights High School, Catholic Central High School, and Grand Haven High School, were selected by the school personnel after voicing their desire to take up some form of engineering as their profession.

Plants in and near Muskegon which participated in the program were: Brunswick, Balke-Collender Co.; Manning, Maxwell and Moore, Inc.; Morton Mfg. Co.; Warren Paper Co.; and Norge Div. of Borg Warner Corp. Other plants visited were: Sealed Power Corp.; Bennet Pump Div. of John Wood Co.; Keller Tool Co.; and Challenge Machine Co. The companies conducted tours of their facilities and held question and answer forums afterward.

After attending a dinner at a local restaurant as guests of the plant managements, the students returned to the schools where ASTE discussion panels were set up for the purpose of briefing the prospective engineers on the opportunities and challenges in the various fields of engineering.

greater new york sponsors automation course

Partial and integrated automation will be analyzed at the 13-week technical course sponsored by Greater New York chapter's education committee in cooperation with New York University.

Designed by Louis Wertman, chairman of the chapter's education committee, and Walter Middleton, president of Production Tool & Methods Co., the course will include lectures and demonstrations of problems and solutions concerned with automation in the fields of electronics and mechanics.

Topics under discussion will be:

Application of Computers to Automatic Production
A. H. Huhnel, The Austin Co.

Application of Punched Card to Automatic Production
I. B. M. Applied Science Div.

Application and Design of Controls for Automatic Production
Dr. F. W. Cunningham, American Bosch Arma Corp.

Automatic Process Equipment Design
Wayne H. Folger, The Heald Machine Co.

Pneumatic and Hydraulic Actuating and Work-handling Devices
Hale Cadieux, The Bellows Co.

Application of Multiple Spindle Drill Heads and Fixturing Devices
A. E. Stehle and associates, Ettco Tool & Machine Co., Inc.

Automatic Production Recording Systems
I. B. M. Time Div.

Hopper and Vibratory Feed Devices
W. McKinsey, Syntron Co.

Classes will meet on Fridays from 7-9:45 p.m. starting February 15, 1957, and ending May 24, 1957, exclusive of holidays.

Members of ASTE, as well as nonmembers, who are qualified design and manufacturing engineers, and their management, will be able to register. Applications will be accepted in the order received.

Requests for information and registration should be sent to: Office of Admissions, New York University, Division of General Education, 1 Washington Square, New York 3, New York.

Other courses offered at the university under the sponsorship of Greater New York chapter are: methods in motion study; quality control; production planning and control; tool design II (die design); abrasives; technical drawing and technical mathematics.

Macomb

Drawing membership from the northeastern section of the Detroit area, ASTE's 142nd chapter, Macomb, was chartered on December 6.

Ernest Hall received the chairman's pin from Past President Leslie Bellamy. Marvin Bunting, staff administrator, presented the membership kit; Director Charles Smillie, the allocation check; and Past President T. B. Carpenter, the chapter baby bottle.

Harry E. Conrad, ASTE executive secretary, gave a talk and introduced President H. C. McMillen who presented the charter.

Mr. Hall later introduced Judge Alton Noe, who welcomed the chapter to the area.

Among those attending were Detroit Chairman Lenard Lovings; Andrew Forster, Oakland County chairman; and other past chapter chairmen. Also in attendance were several industrial leaders.

Looking on as Chairman Eldon Hall displays Macomb chapter's new charter are, from left: Richard Clark, secretary; and C. W. Phelps, second vice chairman.

Sillick Steinback of Chrysler's jet engine plant, received a year's membership in the new chapter in recognition of his invention of the diving bell which is used in submarine rescue work.

Enthusiastic chapter officers believe the area will support a rapidly growing membership.

newest chapters

Long Beach City College

Twenty-two students from Long Beach City College, Business and Technical Division, recently became charter members of the new Long Beach student chapter.

Among the 110 people attending the chartering were: Dean J. E. Hollingsworth, who gave a welcoming address; featured speaker of the program F. C. Preator of the National Education Committee; Wayne Ewing, national vice president, who chartered the chapter and installed new officers; and R. E. Garliss, Long Beach chapter chairman.

Others in attendance were San Gabriel Chairman Lincoln Mager; San Fernando Chairman Al Reno; San Gabriel Education Chairman Robert Edgecomb; Dr. L. E. Cook and Ed Cutler of the National Education Committee.

A group of Long Beach officers and various school and city officials were also present.

Pictured at Long Beach City College chartering from left are: John Hall, newly elected chairman; R. E. Gariss; Prof. F. C. Preator; Dean J. E. Hollingsworth; and Wayne Ewing, national vice president.

INDIANAPOLIS—Ladies night Christmas party dinner is here shown being served to Indianapolis members and their wives at the Antlers Hotel. —*John L. Young*

Tooling Techniques Topic at Rochester Panel

Rochester chapter joined with the National Association of Tool and Die Manufacturers December 3 to present one of the year's most successful meetings, a panel discussion on "Tooling Techniques." Moderators were G. Curtin, Navy Ordnance Div. of Eastman Kodak Co., and L. E. Minges, of the W. P. Stein Co. The following subjects were covered by panel members: "Dies" by G. N. Bader, Rochester A and B Co.; "Jigs, Fixtures, and Special Machinery" by Helmut Walter, Alliance Tool and Die Corp.; "Screw Machine Tooling" by H. Gilbert, Jet Tool Co.; and "Gages" by Chauncey Newton, Anderson-Newton Sales Engineering Co. —*Floyd Weed*

CHAPTER

Hartford Hears Talk On Grinding

Dr. L. P. Tarasov, of the National Editorial Committee, presented an address on the topic "Grinding the Low-Grindability Materials." Following Dr. Tarasov's talk on the theoretical and laboratory side of the problem, Clifton C. Nickerson of the Norton Sales Engineering Dept. presented typical operations and resultant recommendations.

Coffee speaker of the evening was John Ryan of American Airlines, who presented the film "The Mercury," which described the making of reservations through to preparation and flight on a DC-7 from New York to Los Angeles —*C. M. Newbury*

Steam Power Topic at Benton-Harbor

John Longly of Babcock & Wilcox, Beaver Falls, Pa., spoke on the subject of "Steam for Power" at the Benton-Harbor-St. Joseph meeting in December. A sound color film "New Developments in Steam Power" was followed by a panel discussion on nuclear power and possible practical advantages.

—*Orvis L. Johnson*

Metal-Forming Talk at Hendrick Hudson

Seventy members met at the Circle Inn, Lathams, to hear guest speakers from the V & O Press and Henry & Wright review the history of metal forming. Parts formed in progressive dies were exhibited, and a film was shown of improvement and versatility of high-speed dieing machines.

—*Ernest J. Heyman*

LIMA—Shown at the December dinner dance and ladies night festivities are, from the left: Vincent M. Spahr, chairman of the National Constitution and By-Laws Committee, and his wife; the Joseph Weigels; the John Rentzes; and the John Robertsons. —*George Johoske*

PEORIA—The December meeting was devoted to a student program, with H. W. Highwriter, vice president of Fansteel Metallurgical Co., shown at the lectern above, speaking on the metals field. Interested listeners are Wm. Logue, student advisor; R. Van Rossen, technical chairman; Wm. Myers, student group chairman. —*G. K. Davison*

Hamilton Hears of Power Project

"The St. Lawrence Power Project" was the title of the talk given to Hamilton members by L. L. Mullen, municipal information officer of the Hydro-Electric Power Commission of Ontario. Mr. Mullen pointed out that increasing power demands have made it necessary for the Commission to expand its facilities. At the present time, six hydraulic plants are under construction. The plants at Niagara Falls and on the St. Lawrence River are the largest and will generate 2,000,000 horsepower. Existing steam plants are also being enlarged and a start has been made on a small nuclear power plant near the Chalk River in Ontario. —*Russ Wilson*

news and views

LANSING—Feature speaker Donald L. Davis, right, an authority on gadgets and president of the National Gadget Manufacturers Association, points out an innovation to Chairman Glenn L. Crippen and Emcee John Demmer at the chapter's ladies night program. —*R. J. Krumrie*

Springfield, Mass. Visits Armory Museum

A total of 325 members and guests of the Springfield, Massachusetts chapter saw the gun and armor collection at the Springfield Armory's museum December 10. A welcome address was made by the armory's commanding officer, Col. D. G. Ludlam, who talked briefly on armory objectives.

Featured speaker of the evening was arms expert Otto von Lossnitzer, whose talk "Modern Aircraft Weapons," based chiefly on the "Vulcan" 6-barrel rapid-fire aircraft cannon, was illustrated with slides and movies. —*A. M. Johnson*

ROCKFORD—Entertainment for the annual ladies night Christmas party was provided by the Eddie Rice Trio, standing with Chairman Joel A. Jannenga. Mrs. Jannenga is seated, at right, with Program Chairman and Mrs. Clifford Lundquist. Also on the program was the mentalist Mac Murray. —*L. E. Geiger*

New Precision Measurement Technique Shown with Optical Transit at Oakland County

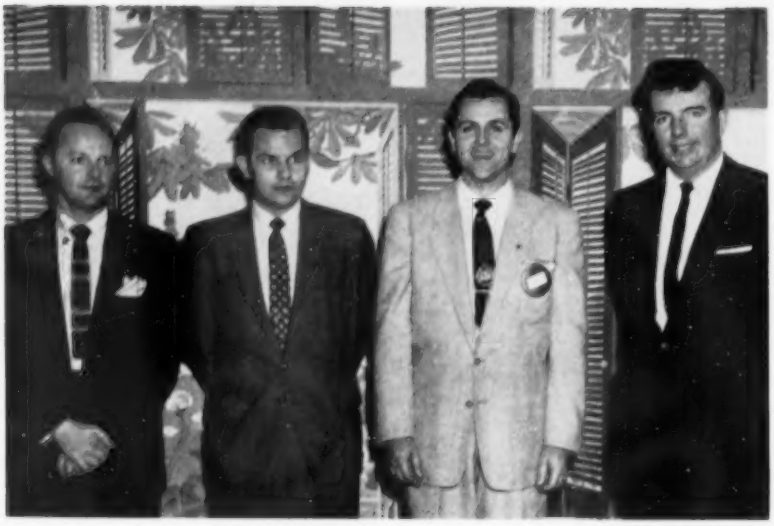
A new method of precision measurement utilizing the accuracy of the optical transit was described by M. C. Anderson of the Charles Bruning Co. at the December technical session of Oakland County chapter.

A sound movie depicting the origin of optical tool engineering introduced the program. It showed the shortcomings in present methods of measurement and alignment, which lack needed accuracy in the construction and inspection of aircraft jigs and fixtures. Colored slides provided illustrations of a variety of situations where optical measurement is used to realize accurate alignment for machine tool erection and inspection.

Following the slides, Mr. Anderson, whose company is the exclusive distributor for Brunson optical instruments, gave a demonstration of optical tooling instruments showing the features responsible for their accuracy in alignment, squaring and leveling. Scale models of a complete optical tooling setup with instruments, stands and tooling bars, were on hand for him to demonstrate the solutions of actual problems posed by his audience.

HAMILTON DISTRICT—Past chairmen who were recently honored by the chapter are: back row, left to right, F. C. Johnson, W. M. Shaw, C. E. Bulmer, G. Gilmour, and J. M. Snyder. Front row from left are: W. A. Dawson, G. Hall, G. Churchill, and C. A. Fisher. —*Russ Wilson*

Chapter News and Views



LONG BEACH—An excellent presentation on "Cutter Design and Application" was made by Paul J. Robinson, right, of Brown and Sharpe, at Long Beach's Dec 12 meeting. Posing with him are, from left: C. D. McNealy, program committee chairman; H. A. Szostek, field engineer with Nelco Tool Co.; and R. E. Gariss, chapter chairman. *—D. B. Welty*

ATLANTA—Shown with their affiliate membership plaques are, from left: Ted Green, American Art Metals; E. A. Anderson and Edward Pram of Southern Saw Service; M. Eidson, Southern Spring Bed Co.; H. T. Walker, Walker Die Tool & Engrg. Co.; H. P. Ulrickson, Lockheed Aircraft; E. L. Walker, Walker Die Tool & Engrg. Co. *—L. C. Volherding*

LOS ANGELES—Past chairmen of the chapter get together at the Christmas dinner dance. From the left, they are: Jacob Walkey, Ed Riddle, Arthur Denis, Carl Almquist, Ralph Chrissie, Paul Slater, and Wayne Ewing, national vice president. *—Gene Grahn*

Milwaukee Speaker Discusses Ceramic Tools

The history and present industrial uses of ceramics was the topic of discussion at the recent meeting at Milwaukee. Speaker E. Kibbitt, sales engineer of the Carborundum Co.'s Stupakoff Div., told of the application of ceramics in electrical insulating materials, and as long-lived tips for cutting tools. He mentioned one of the advantages of the ceramic tool bit, which has a hardness equivalent to that of sapphire, as the fact that, since it is nonmetallic and chemically inert, metal from the workpiece cannot weld itself to the tool bit.

The nontechnical portion of the program was devoted to the community singing of Christmas songs, led by a barbershop quartette. *—Walter Behrend*

SAN FERNANDO VALLEY — Representing the Norton Co. at a recent meeting were Harry Brestlin, left, and Speaker Robert Hamilton, who spoke on the use of diamond grinding wheels on carbide tools. He compared old types of wheels with modern diamond wheels and described the advantages of the latter. *—A. J. Soares*

Executive Night at Chautauqua-Warren

Chairman Cleon L. Douglas introduced William Moreland, national secretary, who spoke on the past history, growth and future plans of ASTE on the national and chapter level. He stressed the part each chapter will play in carrying these plans to completion.

Past chairman Robert J. Wilson introduced the technical speaker, E. F. Burro, supervisor of technical service, Durez Plastics Div., Hooker Electro-Chemical Co. Mr. Burro used slides to illustrate types of plastics used and typical applications. *—Walter Carlson*

Latest in Grinding Described at Racine

Speaker of the evening at Racine chapter's recent monthly dinner meeting was John Ripple, sales engineer for Carborundum Co., whose subject was "What Is New in Carbide Grinding." Of the four new grinding methods described, the first was electrolytic grinding, which has produced savings of ninety percent on diamond wheels.

Mr. Ripple covered also the Elox process, used to obtain odd shapes and holes in carbide, and the ultrasonic method, using a vibrating tool to create odd shapes in hard material. He told of high-speed metal bond grinding with its high surface speed, heavy coolant system, and greater horsepower requirements which produce excellent results, with high savings on diamond wheels.

Seventy-five members and guests attended the technical session and dinner.

—A. J. Michna

SOUTHEASTERN MASSACHUSETTS —Chairman Ralph Manchester is shown presenting an associate membership certificate to Raymond Boynton, representing General Electric of Taunton, Mass. *—E. L. LaBroad*

Northern New Jersey Hears Education Panel

The place of the technical and vocational high school in our education system was the topic of discussion at a recent Northern New Jersey technical session. The three speakers who voiced their opinions were: Harold Weideli, director of the Bergen County Vocational System; Dr. George Morganroth, director of the Essex County Vocations Schools; and Armend Rehm, director of practical arts, Newark Board of Education.

It was the opinion of the panel that the vocationally trained technician, and extension courses for industrial personnel will in large part make up for the lack of trained engineers.

—John Cooke

OAKLAND COUNTY—Optical tooling was the subject of the December meeting. Chapter Secretary Charles Bay tries out the optical transit, responsible for this method of precision measurement, while M. C. Anderson of the Charles Bruning Co., who demonstrated the technique, manipulates the instrument. Vice Chairman E. C. Barnhart looks on at right.

WINDSOR—Ellsworth Stay of Modern Industrial Engineering, Detroit, third from left, spoke on "Deburring and Gear Chamfering" before an audience of 150 at the December meeting. Shown with him are, from left: W. N. Moore, vice chairman; D. M. Duncan, sponsor of the meeting; Chairman E. A. Clifton; and Phil Harry and Paul Stein, both from the speaker's company. *—J. Challoner*

WORCESTER—Members and wives shown awaiting the start of the annual Christmas dinner dance are, from left: Treasurer A. S. Hamilton and Mrs. Hamilton; Chairman and Mrs. L. P. Tarasov; and Vice Chairman and Mrs. J. C. Lalor. *—Leon F. Miller*

chips and chatter

Akron chapter attended its annual Christmas dance at the Firestone Country Club. Dick O'Dea and his committee organized the dance.

Buffalo-Niagara Frontier held its annual Christmas party at the Park Hotel. One hundred ten couples joined in the social hour, games and dancing.

Calumet Area chapter heard Robert F. Pearse, Worthington Associates, speak on developing tool engineers into executives and how to recognize executive ability. Coffee Speaker, Chairman D. MacGregor discussed "What Is a Tool Engineer" before a large audience.

Robert Knight, metallurgical engineer from Crucible Steel, spoke at the **Chautauqua-Warren** meeting on the heat treatment of tool steels, carbon steel and its limitations. He pointed out that temperature controls the change of ferrite and carbon to austenite and, in cooling, the austenite converts to martensite, giving hardness in tool steel.

Chicago chapter enjoyed a grand Christmas party, including a smorgasbord dinner and dancing.

One hundred fifty couples attended **Dayton** chapter's annual Christmas dinner and dance.

Detroit chapter was addressed by Stanley Brandenburg, Monarch Machine Tool Co. on the problems a machine tool manufacturer encounters in carbide turning. Prior to his present position as vice president of sales, Mr. Brandenburg represented his company in the United States, Canada and Europe.

Eugene V. Grumman, general superintendent, The Bullard Co., gave a talk on "Training with the Machine Tool Industry" to **Fairfield County.** Professor Andrew I. Peterson from the University of Bridgeport spoke on "Tool Design, Research and Control," after which a film, "Yankee Tool Market" was shown.

Two hundred **Kalamazoo** chapter members heard the "Story of Measurement," supplemented with slides and a display presented by The DoAll Co.

Ladies night at **Lansing** featuring gadget authority Don L. Davis, was also highlighted by the presence of ASTE National Director and Mrs. William A. Thomas. Mr. Thomas is superintendent of Ford Motor Co.

The subject of carbide dies was covered at the January 3 meeting of **Little Rhody** by Donald E. Oberg, president of the Oberg Mfg. Co., Inc., Tarentum, Pa. Introductory generalized remarks were followed by the showing of three-dimensional slides illustrating all types of carbide dies, accompanied by a running commentary on each die.

"Basic Considerations in Aluminum Forming" covered by E. V. Sharpnack of Reynolds Aluminum Co. was the technical topic of **Long Island** chapter's December meeting.

Merrimack Valley recently heard Lester Noyes, nuclear project engineer from General Electric's East Lynn plant, talk on the processing of uranium from the mine to the consumer. A sound-color movie titled "The Petrified River" was also shown.

The vice president of Cincinnati Milling and Grinding Machines, Inc., Carl M. Beach, discussed "The Importance of a Planned Replacement Program" at the January 8 meeting of **Muncie** chapter. Slides and films accompanied his talk.

William H. McMakin, representing the Metallizing Co. of America, presented a series of slides and a practical demonstration on the numerous applications of metallizing at **Nebraska's** December chapter meeting. After the dinner, members adjourned to the American Machine Works where Mr. McMakin presided at the technical session.

TWIN CITIES—Mr. Dickman, technical representative of Dow Corning Corp., chats with Chairman Phil Armstrong, after delivering a talk on silicones in the metal industry. *—Clifford Gaudette*

Fox River Valley Hears K. W. Donle

K. W. Donle, manager of product engineering for the Tube Reducing Corp., was guest speaker at Fox River Valley's November meeting on the subject of tooling for the manufacture of seamless steel tubing.

Mr. Donle has studied the application of tubing in various industries. In line with this he has followed closely the development of various fabricating procedures applicable to tubing products. Supplementing his talk was the showing of the current television sound film release "Operation Success."—*R. Keck*

The film "Operation Push Button" was presented at a recent **Niagara District** meeting by A. K. Godden, technical representative of Bellows Pneumatic Devices of Canada, Ltd., Toronto. At the conclusion of the film, there was set up a panel of actual working devices which members could operate firsthand, to better illustrate the various applications.

December brought Dr. Robert S. Hahn, chief of research and development at Heald Machine Co., to speak before the **Northern Massachusetts** membership. He discussed rational methods for analyzing various chatter patterns in order to lead investigators to the source of trouble. He also described the improvement of machined and ground surfaces through vibration control.

The Annual Stag Yuletide Party of **Philadelphia** chapter brought approximately 300 tool engineers and their associates together on December 13 at the Penn-Sherwood Hotel. Party fare preceded an entertainment-packed evening.

Phoenix members toured the Reynolds Metals aluminum extrusion plant on December 10. The two-hour trip took them from the raw materials department through the cast house, extrusion, finishing, tube mill, and shipping departments, and the machine shop. Especially interesting was the electronic tester for locating internal flaws in extruded shapes.

Despite blizzard conditions in **Portland, Ore.**, on December 7, sixty chapter members attended the third annual Christmas dinner and party. Dancing and professional entertainment followed the dinner.

Racine chapter's annual fall dance was held November 30, with seventy-

HOUSTON—A happy group of ASTE members and their wives are shown at the annual ladies night and Christmas dance which drew a record attendance of 236 people. *—George Bo-Linn*

five couples enjoying the music of Glen Jensen's orchestra. Ladies were presented with Christmas gifts, and a Swedish smorgasbord concluded the evening.

"Coated Abrasives," a film prepared by Behr-Manning Co., was presented by Messrs. Lehde and Klingsmith to **San Antonio** members at their December meeting. James Frix, professional engineer, gave a short description of the possible applications of the ASTE Handbook, and ended his talk with an outline of projected programs for the chapter during the coming year.

Santa Ana Valley chapter heard John Gibson, product manager for Reliance Magnesium Co., present a slide-illustrated program on magnesium tooling at its recent meeting. At their previous meeting National Vice President Wayne Ewing and Walter Kassebohn, executive vice president of Marchant Calculator, spoke at the executive night program.

A discussion of "Barrel Finishing as a Precision Manufacturing Process" was heard by members and guests of **Santa Clara Valley** chapter December 11. The subject was covered by Ray M. Krieger, Pacific Coast manager of the Almco Div. of the Queen Stove Works, Albert Lea, Minn.

Southeastern Massachusetts heard J. Adams Holbrook, who is both purchasing agent for Morgan Construction Co., Worcester, and a teacher of machine design at Worcester Junior College, speak at their recent gathering. His subject covered what an employer requires of college graduates, and what local ASTE chapters can do to contribute to the development and education of engineering students.

"Dimensioning and Tolerances" was the title of a technical talk by H. H. Katz, vice president and training director of Allied Institute of Technology, at a recent technical session of the **Southeast Kansas** chapter. A well-qualified speaker on the subject, Mr. Katz has devoted eight years of research to develop a scientific basis for standardization, dimensioning and tolerancing.

Dinner, dancing, and professional entertainment were on the bill of fare for the 490 people present at **Tri-Cities'** ladies night dinner dance. Gifts for the women present were in the home accessory category.

John Balint of Avco Mfg. Co. had as his subject "Tools and Metals" at **Williamsport's** December meeting. He stressed the fact that improvement in tooling has not progressed as rapidly as the improvement in jet metals created to withstand high heat and speeds. He discussed the cutting action of tools employed in machining these new jet metals, and its importance in industry.

BALTIMORE—Donald Dorf, left, program committee, and James Rogers, right, are shown talking with Frank P. Brown, Chief of Shops Div., National Bureau of Standards. Mr. Brown discussed the 18 operating divisions, including the Office of Optics & Metrology, which maintains the basic unit of measure and length, mass and time. He pointed out that there will be a problem in the future of establishing a measure of hardness for the diamond. *—Waldo Womeldorf*

BINGHAMTON—Shown at the annual Christmas party, back row from left are: the Marucas, Mrs. Riffanacht and the Adameks. Front row from left: J. B. Riffanacht, the Roberts and the Kings. *—Glyn Williams*

ERIE—Shown is a group of ASTE members who heard W. G. Thomas, of S. C. Johnson & Son, Inc., speak on "Metalworking with Wax." Mr. Thomas spoke of the history and kinds of waxes and described the use of some of his company's products in metalworking. The film of ASTE's 1956 Tool Show and Convention in Chicago was shown. *—Leo B. Weiner*

Coming Meetings

National

ASTE 25th Annual Meeting and Silver Anniversary will be held March 25 through 27 at the Shamrock-Hilton Hotel, Houston, Texas.

NATIONAL STANDARDS COMMITTEE—February 16, Conrad-Hilton Hotel, Chicago, Ill.

Chapter

ANN ARBOR AREA—Feb. 20, 7 p.m., American Legion Post, Saline, Mich. "Ceramic Cutting Tools" by representative of Carborundum Co.

ATLANTA—Feb. 11, 7 p.m., Cherokee Restaurant. Edwin Stouten, Capital Engineering Co., on "Die Design and New Developments in Dies."

BALTIMORE—Feb. 6, 7:30 p.m., at the Engineers Club. "Machining With Silent Sound," by George Brown, supervisor of Ultrasonic Div., The Sheffield Corp.

BENTON HARBOR-ST. JOSEPH—Feb. 14, 7 p.m., Tosi's. "Tooling with Ceramics" accompanied by color slides. Ray Jablonski, Metallurgical Products Div. of GE.

BINGHAMTON—Feb. 6, 7 p.m., Vestal American Legion, Vestal, N. Y. "Thread Rolling" by C. T. Appleton, vice president, Reed Rolled Thread Die Co.

BUFFALO-NIAGARA—Feb. 14, 6:30 p.m., Buffalo Trap & Field Club. "An Inside Look at the Professional Education behind the Iron Curtain" by Edward Keonjian, engineering staff of General Electric Co.

DETROIT—Regular section, Feb. 14. "Advanced Cold Forming Development." Also election. Carbide Section, Feb. 7. "Grinding of Carbide Tooling."

ELMIRA—Feb. 4, 7 p.m., Mark Twain Hotel. "Numericord and Recordotrol Method of Automating Machines and Equipment" by a representative of Giddings & Lewis Machine Tool Co.

ERIE—Feb. 5, 6:30 p.m., at GE Community Center. Robert Way, of Finish Engineering Co. will cover "Paint Processing Machines and Finishing Techniques."

HAMILTON DISTRICT—Feb. 8, 6:30 p.m., at Fischer's Hotel, Hamilton. William Millward, from Tool and Gage Div. of the John Bertram & Sons Co., Ltd., on "Automatic Screw Machine Tooling." This will be members night.

HARTFORD—Feb. 4, election of officers and members night.

HENDRICK HUDSON—Feb. 20. Meeting place to be announced. "Industrial Engineering Standards and Time Studies as Tools for the Tool Engineer" by representative of Ford Motor Co.

LANSING—Feb. 11, representative of the Ingersoll Milling Machine Co. to talk.

LIMA—Feb. 21, 6:30 p.m., Clemans Building. Arthur Gangloff from V & O Press and Henry & Wright Companies to talk.

LONG BEACH—Feb. 13, 7:30 p.m., Petroleum Club. Election of officers and "Putting the Radial Drill to Work" by John Hussey, sales engineer, American Tool Works Co.

LONG ISLAND—Feb. 11, 8:30 p.m., Garden City Hotel, L.I., N. Y. "Fusion Welding and Roll Planishing" by Harlan Meredith, vice president and welding engineer, Airline Welding & Electric.

LOS ANGELES—Feb. 8, 7 p.m., Scully's Restaurant. Slides and lecture, "Putting the Radial Drill to Work" by John Hussey, sales engineer, American Tool Works Co. Election night.

LOUISVILLE—Feb. 12, 7 p.m., American Legion Hall. Election of officers.

MERRIMACK VALLEY—Feb. 7, 6:30 p.m., Andover Country Club. "Ceramics;" speaker to be announced.

MID-HUDSON—Feb. 12, 6:30 p.m., at the Mirabelle, Poughkeepsie. David Loughlin, chief sales engineer of Aircraft Div., Giddings and Lewis Tool Co. to discuss "Numericord and Recordotrol," new machine tool automation systems.

MILWAUKEE—Feb. 14, 6:30 p.m., American Serbian Memorial Hall. "Don't Look Now, But Your Memory Is Showing" by Paul Mermer of Toledo. Election of officers.

MUSKEGON—Feb. 12, 7 p.m., Doo Drop Inn. "Magnesium Tooling Plate: Its Properties Relative to Fabrication and Machining" by W. H. Magnuson, Dow Chemical Corp.

NEW HAVEN—Feb. 14, 6:30 p.m., Waverly Inn, Cheshire, Conn. Talk "Grinding and Grinding Wheels."

NIAGARA DISTRICT—Feb. 7, 6:30 p.m., Rose Villa Inn, Welland, Ont. "Oils in Industries" by Howard Lowe, service engineer, E. F. Houghton Co.

NORTH TEXAS—Feb. 8, 7:30 p.m., Amon Carter International Airport. Election of officers, and "Tooling with Plastics" by John Tarvin, Devcon Corp.

NORTHERN MASSACHUSETTS—Feb. 19, 7 p.m., Union Twist Drill Recreation Hall, Athol, Mass. "Application of Air Gaging to Production Measuring Problems" by Franklin Meyer, Jr. of Taft Peirce Mfg. Co.

NORTHERN NEW JERSEY—Feb. 12, 8 p.m., The Essex House Hotel. Election night and movie "Big Saul—the Story of Steel."

NORTHWESTERN PENNSYLVANIA—Feb. 7, 6:30 p.m., Elks Club, St. Marys, Pa. "Designs and Application of Parts Feeder for Automatic Equipment" by F. E. Smith, president, Perry Equipment & Engineering Co.

OZARK—Feb. 14, 7:30 p.m., Connor Hotel, 4th and Main, Joplin, Mo. "History of Surfaces and Finish, and ASA Standards" by representative of Micrometrical Mfg. Co.

PETERBOROUGH & DISTRICT—Feb. 7, 8 p.m., at the Hiawatha Room of the Empress Hotel. G. W. Barnes on "Ceramic Tooling."

PHILADELPHIA—Feb. 21, 7:45 p.m., Engineers Club of Philadelphia, 1317 Locust St. "Grinding of Carbides," illustrated with colored films, by representative of Carborundum Co.

PORTLAND, ORE.—Feb. 21, 7:30 p.m., Comas, Wash. Plant tour of Crown Zellerbach Paper Mills.

ROCHESTER—Feb. 4, "United States Justice" will be the subject of John A. Roche, regional director of the FBI. Also election night.

ROCKFORD—Feb. 14, 7 p.m., Lafayette Hotel. "Application of Bearett De-Draulic Grip" by Edward Stouten, president, Capitol Engineering Co.

SAGINAW VALLEY—Feb. 21, at Frankenmuth, George Rice of Renaud Plastics, Inc., to speak on plastic tooling.

SAN FERNANDO VALLEY—Feb. 21, 7 p.m., Hody's Restaurant, N. Hollywood, Calif. "Putting the Radial Drill to Work" by John Hussey, American Tool Works Co.

SPRINGFIELD, Ill.—Feb. 5, 6:30 p.m., at The Mill. W. J. Connelly, public relations manager of Bakelite Co. will talk on "The Proper Perspective on Plastics."

TORONTO—Feb. 15, at the Oak Room of the Union Station. Henry D. Sharpe, president of Browne & Sharpe Mfg. Co., to give "Wider Horizons in Machinery Replacement."

TRENTON-DELAWARE VALLEY—Feb. 18, 6:30 p.m., Hotel Hildebrecht. "U. S. Multislide Machines" by Al Melnick, sales manager, U. S. Tool Co., Inc. Films to accompany talk.

TWIN STATES—Feb. 3. Frank Hayes, vice president of Bullard Co., presents "Yankee Tool Maker."

WICHITA—Feb. 12, 6:30 p.m., Wolf's Cafeteria. "Latest Developments and Uses of Optical Instruments." Film and panel discussion.

WINDSOR—February 11, Prince Edward Hotel. Program on manufacture and application of carbide-tipped cutting tools, sponsored by Wesson Cutting Tool Co.

WORCESTER—Feb. 5, at the Crystal Room of the Bancroft Hotel. "Operation Pushbutton" film from Bellows Co., Akron.

Special tribute was paid **Past President Roger Waindle,** president of Wai-Met Alloys Co., by The Investment Casting Institute for his work in writing the metal specifications code of the Institute, and for all commitee work to which he has been assigned.

William A. Dawson, Hamilton District, was re-elected for a second term as national president and chairman of the board of directors of Queen's University, Kingston, Ont. Mr. Dawson is a past director and national secretary, past chairman of the National Professional Engineering Committee and of Hamilton District.

The Blackall Machine Tool and Gage Award was awarded jointly in 1956 to **Orlan W. Boston,** Ann Arbor, Professor Emeritus of mechanical and production engineering at University of Michigan; and **William W. Gilbert,** Schenectady, formerly a member of the National Education Committee, who is machinability manager of GE's Manufacturing Services Dept.

Erwin J. Kaiser, Fond du Lac, currently general manager of the Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., has been named staff vice president in charge of manufacturing.

members on the MOVE

V. Gleasman, Cleveland, won third prize for redesigning machinery components for production in gray iron, in the Gray Iron Founders Society's 1956 Redesign Contest.

Douglas R. Starrett, Northern Massachusetts, has been appointed executive vice president of The L. S. Starrett Co., Athol, Mass.

Richard F. Howe of Hartford, has been named manager of experimental manufacturing in the Research and Advanced Development Division of Avco Mfg. Corp.

J. King Hoyt, Jr., Golden Gate, has become an officer and member of the board of directors of the new corporation, A. Milne & Co., Inc. He is executive vice president and treasurer.

John McCafferty, Rochester, is associated with the Viking Tool and Steel Co., Inc., representing Universal Cyclops Steel Corp. on tool steels, stainless steels and high temperature alloys.

Five Louis-Joliet members have been promoted by Caterpillar Tractor Co.: **Cecil Fenwick** has been named a planning staff engineer at the Australia plant; **Howard Gilkeson** is now production manager of the Australian plant; **Roy Crady** has been promoted to buyer of tools and machinery in the Caterpillar Joliet plant; **Mel Burdett,** past chapter chairman and member of the National Constitution and Bylaws Committee, was named manager of the purchasing of tools, machines and non-production supplies at the Peoria plant; **Jack Lind** has been promoted to general foreman in maintenance at the Joliet plant.

Albert L. Knapp, Hartford, has been elected to the board of directors of Pratt & Whitney Co., Inc. He is vice president and manager of the Machinery Div.

Irvin R. Spangler, Detroit, has been appointed assistant sales manager for Machine and Tools Div. of Michigan Tool Co.

Peter R. Noling, Rockford chapter, has been named sales representative for the Machine and Tool Div. of Barber-Colman Co. in Southern California.

Robert G. Chown, Long Beach, has been appointed sales engineer by The Teglen Engineering Co., Inc.

J. S. Gillespie, Detroit, acting manager of the industrial diamond project for GE's Metallurgical Products Dept., has been named manager of engineering.

A. H. Schott, Cleveland, has been appointed general manager of the Crankshaft and Camshaft Div. of the Ohio Crankshaft Co.

Harry L. Armiger, Detroit, received one of the welding progress awards sponsored by the James F. Lincoln Arc Welding Foundation.

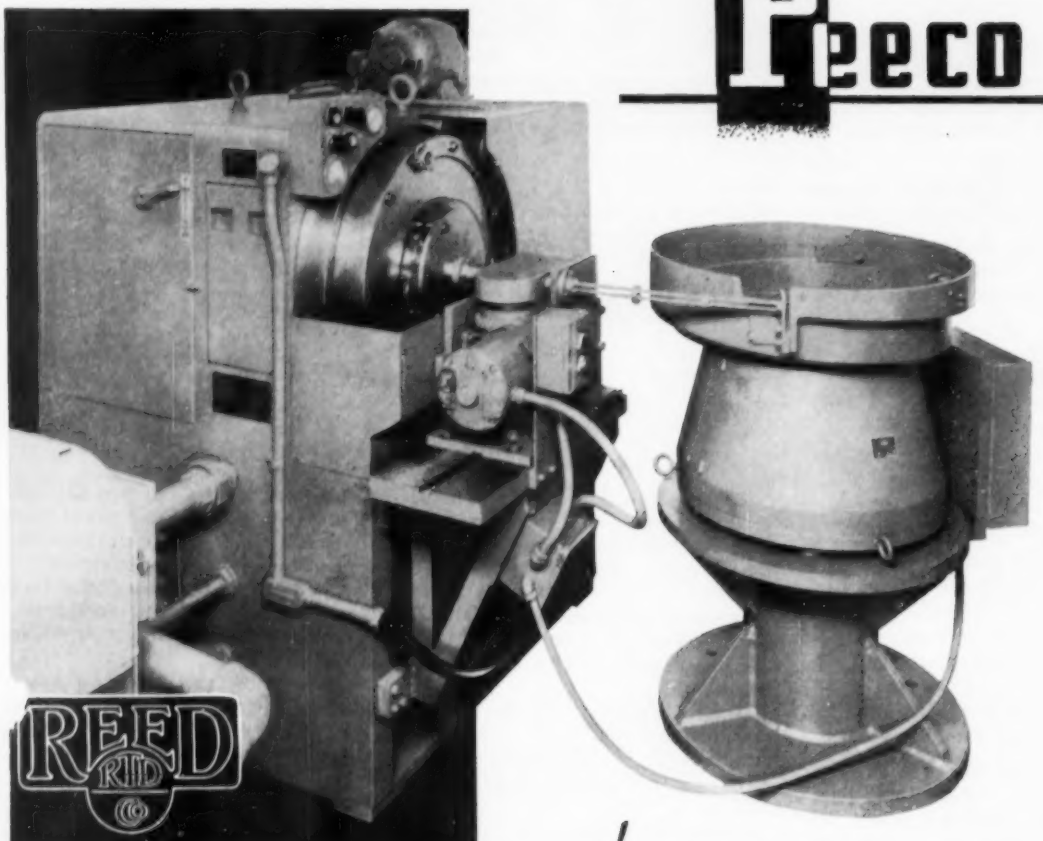
Obituaries

Joseph A. Deck, immediate past chairman of the Fort Wayne chapter, tool engineer at International Harvester Co., Bueter Road plant.

Paul Wahlund, second vice chairman of Des Moines chapter, owner of Wahlund Mechanical Lab.

PRODUCTION EQUIPMENT

produces MORE with Peeco



REED ROLLED THREAD DIE CO.
production equipment *Now* includes
DEVELOPED **Peeco** FEEDERS

The PEECO Vibratory Parts Feeder (Model 25) pictured here is the feeding mechanism which supplies a continuous flow of blanks for the A23 Reed Thread Rolling Machine. Production rate of this machine for rolling high pressure stud threads varies from 70 inches (and up) per minute, depending upon the outside diameter of the blank and the number of threads per inch to be rolled.

Peeco

As a leader in the field of vibratory parts feeders PEECO is contributing its share towards the greater capacities being achieved by new production equipment. We are glad to include, among the companies in this field now being served by PEECO, the Reed Rolled Thread Die Co. of Holden, Massachusetts, specialists in thread and form rolling tools and equipment.

If you want to produce more, send for bulletin # 536 and ask for the name of the PEECO representative in your area.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

PERRY EQUIPMENT & ENGINEERING CO.

ERIE, PA. • • • DIVISION OF AUTOMATION DEVICES, INC.

PROGRESS IN PRODUCTION

PRECISION FITTING TO AVOID CORROSION

A plating technique called Dalic has been developed to overcome the problem of fretting corrosion commonly encountered with antifriction bearings. Using this process and materials, a tight uniform fit is achieved between bearing rings and the housing or the shaft and to hold the bearing in place. Even under vibration it will not seize the shaft or cause galling.

A thin deposit of soft metal coats the outer surface of the bearing rings. During press fitting the metal conforms in a shrink fit and completely fills the space between bearing and the stationary machine member. There is no need to machine or grind bearings to size. Four metals including tin, cadmium, copper and silver, have been found suitable for the work. Of these, tin appears most acceptable from all considerations. Deposit thickness varies with size and type of bearing and the service it will encounter. Normally a tin plating of from 0.0002 to 0.0005 is satisfactory. Where greater buildup is desirable, it can be accomplished—sometimes by alternating between various metals.

To get vibration-proof fit for a bearing, this housing is Dalic plated with 0.0002 to 0.0005 in. of tin. Entire plating operation takes about 3 minutes.

Using this means of area plating, the operator can plate only the section of a housing, for example, which is to receive the bearing, rather than immerse the entire unit in electrolyte. A special rectifier with a finely graduated voltage control permit deposits accurate to within 0.00005 in. Two leads are connected to the rectifier—the cathode is clamped to the work, and the anode to the stylus with which the plating solution will be applied. Choice among several types of styli depends on the area to be plated. Ordinarily a comparatively small air-cooled stylus is used.

For the simple plating operation, the housing, if small enough, is chucked in a low-speed lathe and rotated. The cathode lead is connected to the lathe, the stylus in the anode wrapped in cotton and the proper voltage selected on the rectifier. After the cotton swab has been dipped in plating solution, it is held against the rotating bearing housing which has been previously cleaned electrically using the same Dalic apparatus with a special cleaning solution.

If the housing is too large for such handling, the same result can be obtained in place by swabbing the wet stylus around the periphery of the surface to be plated. As an alternative, the bearing itself may be chucked, and the ring surfaces plated, although precautions should be taken to prevent electrolyte from penetrating the bearing races and ruining them.

Under ordinary circumstances, voltage control is set at about 12 to yield an equivalent current density of 10 amp per sq in. The resulting deposit obtained in approximately 2 to 3 minutes, is dense and free of porosity.

CARD CONTROLLED LATHE SPEEDS PRODUCTION

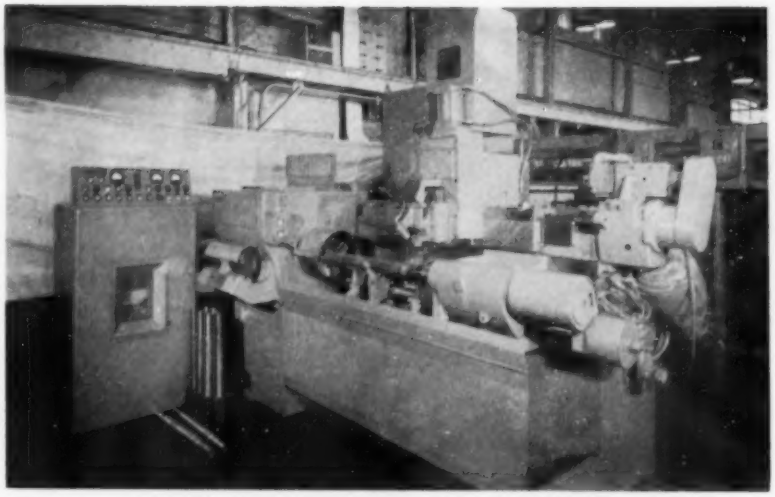
After more than a year of experimental operation of a punched-card-controlled lathe, results indicate it is possible to speed production cycles by going directly from process drawings to

Operator places a series of punched cards into the numerical positioning control which will direct operation of the lathe. This control was developed by G-E's Specialty Control Dept.

finished pieces. Experiments were conducted by Sunstrand Machine Tool Co. General Electrical numerical positioning control was applied to the Sundstrand Model 14 multi-cycle, single-point production lathe. The setup showed it is practical to punch control cards directly from process drawings. From that point, direct production operations are possible.

In the equipment tested, such control brought about an 80 percent reduction in setup time on many jobs, and a consequent production rise. As a result, it was possible to produce a wide range of parts on the test unit with a minimum of changeover time.

One man can efficiently operate as many as five punched-card-controlled lathes simultaneously, depending on the cutting cycle. To adjust a lathe for a variety of pre-programmed jobs, he merely changes the control cards which direct the machine's operation.



Numerical positioning control is at the left of the lathe it controls

In a specific application, the machine is used for general step turning. Punched cards control the speeds and feeds at which it operates. Using this type of control, the lathe has a range of eight spindle speeds and feed rates. It is capable of roughing or finishing over the range of 280-2025 rpm spindle speeds, and 7½ to 29½ ipm longitudinal feed.

DEVELOP TECHNIQUE FOR 'PATTERN' HARDENING

Surface hardening a peculiarly shaped part posed a difficult problem of processing. The piece, a hyperbolic shaped roller made of AISI-SAE 1045 steel, is approximately 4 in. high and 2½ in. in diameter. On the upper and lower outside curved surfaces it is surface hardened to an ⅛ in. depth while a ¾-in. band in the middle is left soft. Inside each hollow end of the roller, a straight portion corresponding in position to the outside curved section also is surface hardened. The bottom of each end recess is left soft.

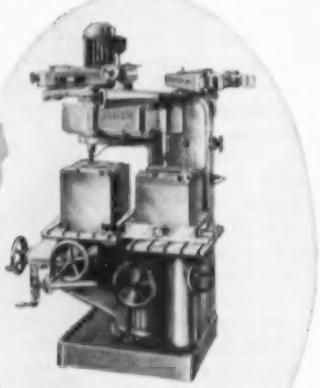
When the problem was brought to National Cylinder Gas Co. for solution, engineers found it necessary to develop special equipment taking into consideration composition of the steel and its hardening characteristics, the heat pattern provided by the flame-hardening burner, and the method of flame application.

Apparatus developed for the job holds the roller half submerged in water. An electric motor beneath the water tank spins the roller at 100 rpm while it is heated by two oxyacetylene burners: one for the outside surface, and a second for the interior surface. Burners are designed to give heat patterns that

ECONOMICAL, ACCURATE PRODUCTION OF DIES AND MOLDS WITH THE LATEST

DECKEL

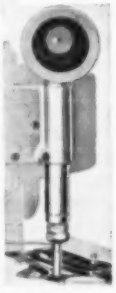
universal pantograph DIE SINKING MACHINE model KF12



Deckel KF12 makes rapid, accurate enlargements or reductions from 1:1.5 to 1:4 as well as 1:1 duplication. The cutting tool covers an area up to 15¾" x 15¾" or up to 10" x 19¾".

Deckel die sinking machines are justly famous for their accuracy, production rate, and ease of operation. The KF12, latest and largest Deckel model, does heavy die-sinking jobs which formerly required much greater investment in equipment. Spindle speeds from 60 to 10,000 r.p.m. enable you to do rough and finish milling, as well as light engraving, on the same machine. The newly developed, "mirror image" milling attachment produces right and left hand dies and molds from the same pattern. Other important features are illustrated below.

Optical contacting device makes rough milling faster, more accurate. And, accurate rough milling reduces time for finishing.



Saddle elevating motor rapidly raises or lowers master and workpiece at the same time.

Circular forming attachment permits generating spherical shapes.

Get in touch with us soon for information on this or other Deckel machines: 2-DIMENSIONAL ENGRAVERS • 3-DIMENSIONAL ENGRAVERS UNIVERSAL MILLERS • UNIVERSAL TOOL & CUTTER GRINDERS

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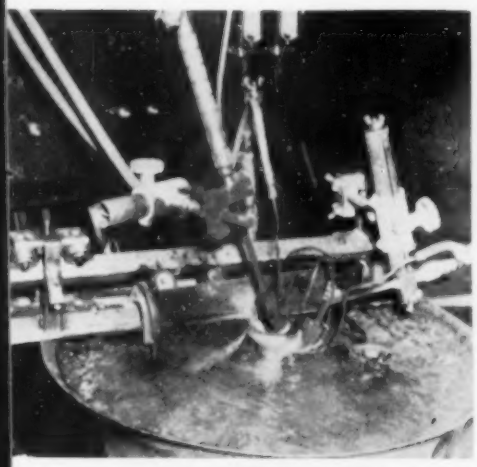


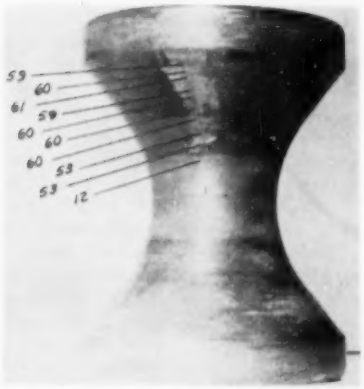
The hyperbolic-shaped roller is spun from underneath by a shaft, belt connected to an electric motor. Two oxy-acetylene burners provide heat patterns to heat exterior and interior surfaces of the roller. One end is heated at a time.

closely limit the area to be heated and hardened.

Hardness obtained on roller surfaces varies from 53 to 61 R_C, with the soft middle area remaining at about 10 to 12 R_C. Hardening changes the surface structure of the steel from fine grained pearlite and ferrite to a martensitic matrix containing needles of bainite. Varying burner position, flame adjustment and speed of rotation affects both microstructure and case hardness.

Heating time is approximately 20 sec for each end, with each being heated and quenched separately. Gas consumption is about 0.09 cu ft of acetylene per square inch of roller surface-hardened. Acetylene is supplied at a rate of 181 cfh at 12.5 psi, and oxygen at 220 cfh at 26.5 psi, giving an oxygen-acetylene ratio of 1.21.

Here is shown the pattern of curved surface hardened area as it runs from 53 to 61 R_C. A ¾-in. wide band in the middle of the roller remains soft at 12 R_C.



USE POWDER METAL PROCESS FOR WROUGHT PRODUCTS

Known advantages of powder metallurgy have been brought to makers of wrought products with development of the Sinterwrought process by research engineers of Sintercast Corp. of America. By this new method, it is possible to achieve any symmetrical shape such as wire, rod, strips, bars and tubes of long lengths. Resultant products have greater strength and ductility than those from conventional powder metal processes, and without the impurities present in cast billets from which conventional wrought materials are made.

Metals handled by the method include aluminum, copper, nickel, cobalt, carbon steel, stainless steel and alloys of these metals. Recent experiments also indicate that the newer metals to industry such as columbium, titanium and zirconium also may be handled by Sinterwrought technique.

The technique also gives fabricators precise control of composition; in addition critical metallic or nonmetallic ingredients can be added to compositions in a uniform dispersion. Now it is pos-

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Guide Pins and Bushings!"

"Since changing to Lamina Guide Pins and Bronze-plated Bushings on our dies, they have run more than 20,000,000 hits . . . and they're still going! Formerly, the best we could get was 4,000,000 to 5,000,000 hits on any make." *This is a typical quotation from an actual user letter.*

Lamina bronze-plated wring-fit bushings are pre-finished on the I.D. Seated on a shoulder square with the die shoe surface and secured by special retainers, they assure distortion-free, full bearing surface that results in better die alignment, less maintenance and longer die life.

Lamina Guide Pins are special tool steel, heat treated, spray quenched, hardened, ground and burnished. The uniform, hard surface resists wear, while the tough core won't bend in installation or use. These dimensionally accurate pins do not "mushroom" or get out of round, and require no "running in."

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SHOULDER TYPE PIN. ½" to 4½" diameter. Straight and Removable types also available.

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SPECIAL PINS AND BRONZE-PLATED BUSHINGS for any application . . . tailored to your requirements. Send prints for prompt quotation.

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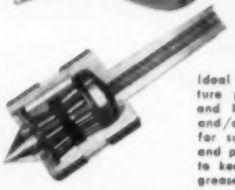

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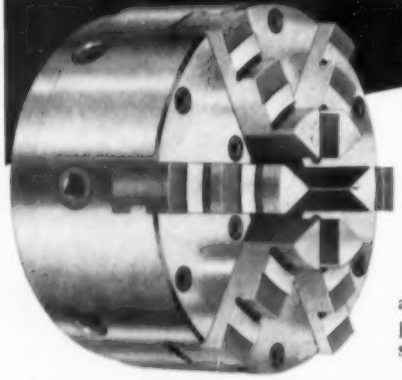

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sible to produce wrought materials with a homogeneous structure even though the original ingredients of the powder mixture are partially or totally insoluble in each other. This is of special interest when specific properties, such as those required in electronic, nuclear, electrical and high temperature applications, may be met by uniformly dispersed addition elements.

An example of this type work is the aluminum strip and foil made from

Stages in production: metal powder mixture (left), ingot produced from these powders (center), and finished wrought shapes made by Sinterwrought process (right).

aluminum metal powder containing a uniform and accurate distribution of a small amount of an element needed in atomic energy reactors. This strip differs from other sintered powder metal products in that it has density, elongation, and mechanical strength of conventional rolled aluminum foil. However, it contains precise amounts of additives which cannot be incorporated in normal melting methods.

NEW CENTER SPECIALIZES IN COMPONENT 'TORTURE'

After three years of planning and construction, Chevrolet's new Engineering Center, located north of Detroit, is operating at top efficiency to conceive, design and test Chevrolet cars and trucks prior to putting them into production. The ultra-modern center brings under one roof the equipment for designing, planning, creating and examining, and the engineers and technicans to man it.

The structure itself is basically three interconnected units—a four-floor office building, a single story shop and a test laboratory. Adjacent is the recently completed General Motors Technical Center which carries on closely linked research, engineering and styling activities.

Facilities of the multi-million-dollar structure include an approximation of a self-contained "automobile factory" capable of turning out almost any type of experimental vehicle. This shop provides among its equipment three presses with capacities up to 2,500 tons. A second highlight of the center is the

In one of the 18 dynomometer rooms, an engine is tested to secure data on how it will perform at sustained high speeds or under conditions simulating actual road driving.

elaborate test chamber which contains 6,000 pieces of equipment and instrumentation.

Any condition which might be met by the cars and trucks are duplicated in greater severity in the laboratory. An artificial sun, for example, is capable of searing paint off a car, while a cold room drops temperatures to -65 F, and a special fan churns up 90-mile-an-hour winds. In a series of vehicle "dynamics rooms," two sets of giant ice tongs swing cars and trucks onto a rack to be twisted and bounced.

Some 720 test projects, many of them consisting of a dozen individual tests requiring several months of time, are conducted in the laboratory in a single year. These tests, to determine durability and physical and operating characteristics of the various components, are coordinated with actual road tests.

In a portion of another test area, welded bar is strain tested.

AUTOMATIC SEALING STEPS UP OPERATION

Up to 6000 parts per hour are sealed to Air Force specifications by an automatic packaging machine that has reduced cost of packaging 0 rings by 60 percent at Ford Motor Co.'s Aircraft Engine Div.

Actually, the unit, designed by Product Packaging Engineering, provides a complete, automatic packaging system. Small parts are sealed in individual envelopes, each printed with part and contract number, to government specifications. This arrangement avoids hand sealing operations, while protecting the part against spoilage from grease, moisture or corrosion.

Used in Ford's Spare Parts and

IT OSCILLATES!
ADJUSTABLE FOR OSCILLATING FREQUENCY AND LENGTH OF STROKE
HAMMOND OSCILLATOR
SPECIALLY DESIGNED FOR USE WITH
NEW ANOCUT ELECTROLYTIC GRINDING PROCESS
· CUTS DIAMOND WHEEL COSTS
· GRINDS FASTER
· SOON PAYS FOR ITSELF

NEW Hammond ELECTROLYTIC
OSCILLATING CARBIDE TOOL GRINDER

Write FOR CATALOG

The *New* Hammond Oscillating Carbide Tool Grinder was designed primarily for use with the Anocut Electrolytic Grinding Process. It can also be used for conventional grinding without the Electrolytic "Power Pack".

A controlled and precise method, the Electrolytic process removes stock electro-chemically. It is *not* to be confused with electro-spark or electro-arc methods. It reduces diamond wheel consumption 80 to 90%.

Outstanding feature is the precision, dynamically balanced, OSCILLATING spindle . . . with *variable* oscillations per minute and *variable* length of stroke. The operator no longer oscillates the tool . . . the wheel does the work, with greater speed, smoothness, accuracy, and less physical effort.

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Packaging Dept., Assembly and Test, the Pak-O-Mat seals parts ranging in size from ¼ in. to 3 in. Parts feed from a hopper down a vibratory chute and onto a moving strip of heat sealable paper. An upper strip of sealing material, printed with specifications, part and contract number plus other pertinent information, joins the lower strip at the sealing rolls where the pouch is heat-sealed on four sides and cut. The machine prints, seals, packages and cuts off automatically. It also automatically rejects empty packages.

PRODUCE TITANIUM HEADS BY SPINNING

No dies or stamping equipment were used when Lukens Steel Co. formed a head of solid titanium. This accomplishment was considered special because it provided a lower cost method of forming this highly corrosion resistant metal and pointed to the possibility of broadening its use particularly in the chemical and other process industries.

Prior to this work, titanium heads were made only with dies which were individually built for each variation in size and shape.

In a research program conducted jointly by Lukens and Rem-Cru Titanium, Inc., a commercially pure titanium plate was placed on a spinning machine and worked at a minimum temperature of 600 F. The plate previously had been heated under close temperature control at 1400 to 1450 F. Using standard equipment, an eliptical shape head then was spun 16 in. in diam and ¼ in. thick.

DEVELOP SPECIAL GROOVING TOOL

A special cutting operation which required carbide cutting edges resulted in development by Kennametal Inc. of this multiple grooving tool with twelve ½-in. diameter Kendex button inserts.

Indexable "turnover" button inserts, backed by carbide shims, have a number of cutting edges on top and bottom that depends on the depth of cut. The 8-in. long steel plate that backs up the inserts assures accurate groove spacing when inserts are indexed to new cutting edges.

MATERIALS-HANDLING TIME SAVED BY CRANE SCALES

To reduce time lost by an inventory control system that is based on weighing bundles of in-process aluminum tubing, Channel Master Corp. has installed Baldwin SR-4 crane scales between the crane boom and the load. The crane cab is equipped with a meter that indicates the net weight of the load. This meter adds the weights registered by two load-cells and subtracts the weight of the slings.

Formerly, the crane picked up a bundle at one processing point, carried it to platform scales and lowered it. After weighing, the bundle was again picked up and then carried to the next processing point. With this method, about three minutes of production time was lost at each weighing and weight was determined two or three times during processing.

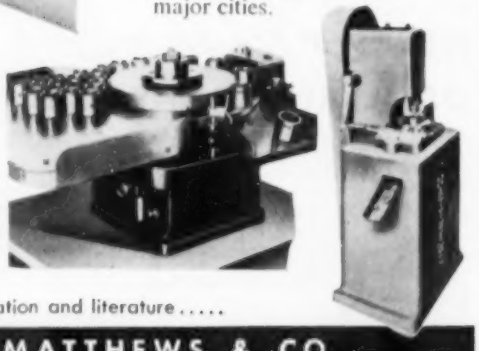
With the SR-4 crane sales, the crane lifts a bundle of tubing at one department and pauses while the crane operator calls out the weight to the rigger, who records the weight on the job ticket and punches it on a tag attached to the load. The bundle is then delivered directly to the next processing department. Under this system, weight of a load is determined in less than one-half minute and there is no waste motion.

MARK IT *as you* MAKE IT! *for Profit Saving*

By incorporating a Matthews' Marking Station in your processing. Whether your product is round, contoured or flat; metal glass or plastic . . . one of Matthews' Marking applications is ideal for you.

Equipment to print, emboss, indent (by roller or stamping) or blast-etch marking is adaptable to most automatic operations.

Consulting service without obligation. Factory representatives in most major cities.



Illustrated are some of the many adaptations of Matthews' "Rotary". Automatic positioning, marking and ejection. Can fit into your production line and mark at your rates! Accommodates tubular, tapered or shaped rounds.

Write for complete information and literature . . . . .

JAS. H. MATTHEWS & CO.

3923 Forbes St., Pittsburgh 13, Penna.

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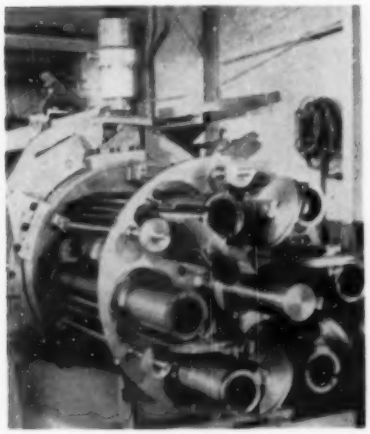
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-160

TOOLS of today

Stock Loader for Bar Automatic

Stock loading of bar automatics is simplified by this multiple-spindle bar feed that automatically indexes to as many as eight fixed-stop positions on bar automatics, holds several hours' supply of stock, ejects remnants, and reloads automatically. In continous field-test operation, the feed has performed at 96 per cent of machine capacity.

This automatic, multiple spindle bar feed consists essentially of a magazine on which stock is racked diagonally to a reel containing four, six, or eight split stock-tubes, or spindles, depending on the number of machine operations and corresponding exactly to spindle positions on the bar automatic; air-operated motors, one to a spindle; a stock pusher within each tube; an air-operated braking mechanism; an hydraulic check unit, controlling the feedout of stock against the stock-stop at a constant rate, and a safety shut-off device.



Indexing cycle for which the AMS bar feed is set is based on the longest operation in the machining sequence.

Depending on its size, stock for several hours' work can be racked in the magazine in a single loading operation, and stock may be loaded at any time. Operation of the machine is automatic and involves no manual adjustment during a production run.

The bottom bar in the magazine rests on pins which retract, permitting the stock to drop when a split stock-tube in the reel is in position to accept it. The stock-tube is loaded in about ½ second.

Stock pushers, operated by air motors, feed stock through each tube at a constant rate.

A bar can easily be removed from a stock-tube during a run, if necessary. Where machining cycle is 10 sec or longer, a new bar can be loaded without shut down.

The AMS bar feed can accommodate stock sizes from 2 in. max to ¼ in. min.

Lipe-Rollway Corp., Gedders and Lipe Sts., Syracuse 1, N. Y. **T-2-1611**

Automatic Gaging System

This Multi-Feedbak device combining multiple automatic gaging and feedback machine control in a single unit.

It is designed to overcome the problem of adapting individual size and machine control units with feedback at each machine to achieve precise, high speed measurement of the parts being produced by a series of machines.

The new unit consists of a set of gage tooling and provisions for receiving and measuring precision parts from each of a series of machines. Individual parts are conveyed through the automatic gaging control system through a series of part-handling devices. A "memory system" pointed out by arrow in the illustration positions the incoming parts into gaging stations one at a time as they flow from the different machines.

A system of electrical gage signals and lights transmits information from the gaging setup to the machine that produced the specific part so that necessary corrections may be made immediately if it begins producing a pre-determined number of reject parts. These signals anticipate and correct by "loop feedback size control," or a combination of both.

In cases where all parts passing through the gaging control unit are not identical, two gaging stations are incorporated into the device. In cases where basic dimensions may be the same but overall sizes may be different, a primary gage station inspects the

basic dimensions and a series of secondary stations inspect the variable dimensions of the part.

The memory system may also be used to segregate acceptable parts into individual lanes or chutes corresponding to the various types of parts to be produced.

In use, the Multi-Feedback controls as high as 20 machines simultaneously.

The Autometrology Div., The Sheffield Corp., Dayton 1, Ohio. **T-2-1621**

Automatic Hardness Tester

Up to 1000 hardness tests per hour can be performed automatically by hand-feeding individual pieces to this console model automatic hardness tester, Size 3. The unit will test any metal on the standard Rockwell scale, and will automatically classify tested workpieces into one of three categories—correct, too hard or too soft. Hardness limits can be controlled to within two Rockwell

numbers. The tester is equipped with an automatic counter, and stops automatically if workpieces are misfed.

Workpieces can be tested by manual feed and manual disposal or with manual loading and automatic disposal and hardness classification. The unit can be set up to test materials that vary in thickness from 0.030 to 6 in.

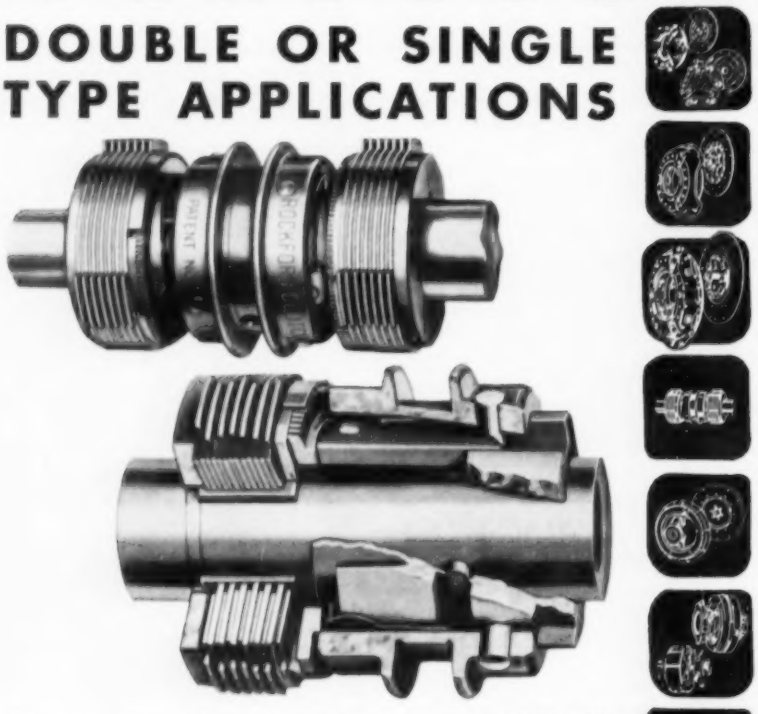
A switch changes the cycle from continuous testing to single operation. Control of the unit for individual testing is through a push-button or a foot switch.

A system of lights on the tester indicates the hardness classification.

Wilson Mechanical Instrument Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. **T-2-1622**

ROCKFORD

DOUBLE OR SINGLE TYPE APPLICATIONS



These compact, powerful, multiple-disc clutches are helping product engineers to reduce size and weight of the vital link between the driving and driven units of machine tools, lift trucks, overhead cranes and a wide variety of other production equipment. They readily fit into product designs, accommodating great torque capacity within small size. Precision grinding insures perfect fit on the clutch shaft. Symmetrical contours avoid drag that is caused by centrifugal force.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER-TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD Clutch Division BORG-WARNER

1329 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales: Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

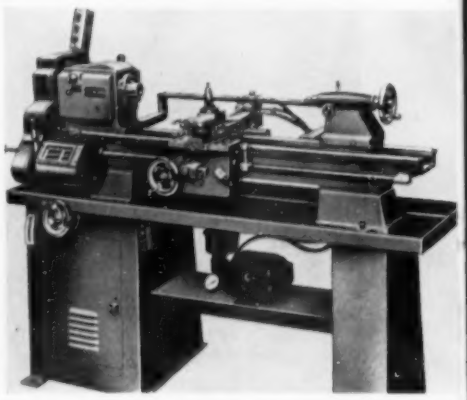
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-162

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tracer Lathe

This 12-in. heavy-duty duplicating lathe with hydraulic tracer provides automatic reproduction of multiple diameters, tapers, bevels, shoulders, radii, grooves and chamfers quickly and to the same accuracy as the template.

Hydraulic cylinder, housed in servo motor, provides power to firmly feed and hold cutting tool. Lathe is powered



Toolmakers' microscope reads to 0.0001" and 1 minute of arc. Co-ordinate range 4" x 2". Compact built-in rotary stage.

Make precise measurements to 0.0001" and cut rejects with Gaertner microscopes

Here are reliable, easy-to-use microscopes for precise, indisputable measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. With these instruments you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear.

Through the engineering facilities at our Chicago plant, these versatile, well-constructed microscopes can be adapted to meet your exact needs. Find out now how you can gain new production savings with Gaertner measuring microscopes.

Coordinate Measuring Microscope

High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

Micrometer Slide Comparator

Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

Scale Micrometer or Shop Microscope

High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

Write for Bulletin 161-54

The Gaertner Scientific Corporation

1241 Wrightwood Ave., Chicago 14, Ill.

Telephone: BUckingham 1-5335

INDICATE A-2-163-1

by a 1½ hp motor. Motor, pump, reservoir and pressure gage are an integral unit and are located on shelf under lathe chip pan. Template mounting bar is designed for templates made of ⅛ to ¼ in. flat stock.

Adjustable speed drive makes any spindle speed from 43 to 222 rpm and 250 to 1300 rpm available without stopping lathe or shifting belts. Spindle has 1⅜ in. bore and 1 in. collet capacity.

Tracer handles work up to 2½ in. diameter differential and 18 in. in length. Slide feed, in and out, is infinitely adjustable from 0 to 15 ipm. Swing is 12¾ in. over bed, 12⅜ in. over saddle wings, and 7⅝ in. over cross slide. There is 33½ in. between centers.

Clausing Div., Atlas Press Co., 21114 N. Pitcher St., Kalamazoo, Mich. **T-2-1631**

Mist Lubrication

The Jet-Mist generator is designed to spray air-liquid coolants or air-oil lubricants directly to the cutting area for high-speed machining and metal drawing and forming operations.

Easy to mount and simple to operate, the device is equally suitable for continuous operations or for medium and

short-run productions. It requires no pressurized coolant tanks, regulator valves, control panels or special spray heads.

Installation of the Jet-Mist unit uses the machine tool sump pump with a ¼-in. NPT airline connection for single or multijet mist spray of coolant.

Pressure regulators and pressurized coolant tanks are available for machine tools without sump or sump pump.

Arrow Tools, Inc., 1947 S. Kostner Ave., Chicago 23, Ill. **T-2-1632**

Coil Cradle

Coil stock can be supplied to presses and other equipment from this Koil Kradle, which is equipped with casters, which enable it to be moved easily and facilitate alignment to machines. The unit is available in capacities from 1200

• *A good chair is like a good wife...if you choose with care, it will look after your comfort and aid you in your work for a long time to come*

Cramer CHAIRS ARE GOOD CHAIRS

Scientifically planned to aid YOU in your work . . . designed to support you comfortably whether you're chewing your pencil or bent over hard at work . . . engineered from the quality materials YOU would recommend, with independently adjustable seat, back and footring to conform to your physique . . . and with removable, replaceable covers in a wide range of fabrics and colors to match YOUR decorating plan.

Pictured, Cramer Hi-Model 4D-22T with forward-tilt seat; others available. All are low-gravity balanced for safe use on casters if desired.

LIKE MORE INFORMATION?

Cramer Posture Chair Co., Inc., Dept. TE 27
1205 Charlotte, Kansas City 6, Mo.
Please send me complete facts on the Cramer Hi-Model chairs designed for working architects and engineers.

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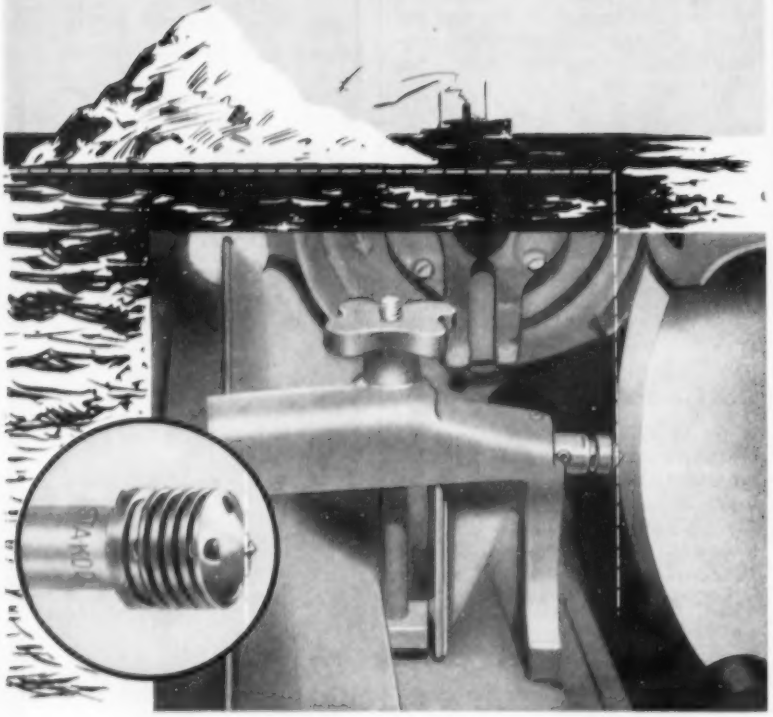
INDICATE A-2-163-2

THERE'S MORE HERE THAN MEETS THE EYE...



In an iceberg or in a J. K. Smit Diamond Tool only a fraction shows above the surface.

Everyone knows about the unseen portion of an arctic iceberg. Many do not realize the unseen factors that lie beneath the surface of a J. K. Smit Diamond Tool, such as . . . our constant research to find still better methods of manufacturing Diamond Tools, the unquestioned integrity of our company since 1888, the manufacturing skills that have been learned and passed on through all those years, and quality control of manufacture for tool duplication.

All these hidden assets count much toward maintaining our position as a leader in the industry today.

When *your* next job specifies a diamond tool for any purpose contact J. K. Smit. Our field representatives are trained and qualified to assist you with any standard or special application.

J. K. SMIT & SONS, INC.
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MURRAY HILL NEW JERSEY

Additional plants in London, Paris, Amsterdam and Toronto, Canada

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to 16,000 lb and handles coils up to 48 in. wide by 60 in. in diam.

Front wheels of the portable model swivel for steering. As tongue is lowered, bed is lifted by a cam, and clears the floor by ¼ in. With tongue in vertical position, front of bed is lowered to set solidly on the floor.

Benchmaster Mfg. Co., Gardena, Calif. **T-2-1641**

Bond for Fast Cutting Grinding

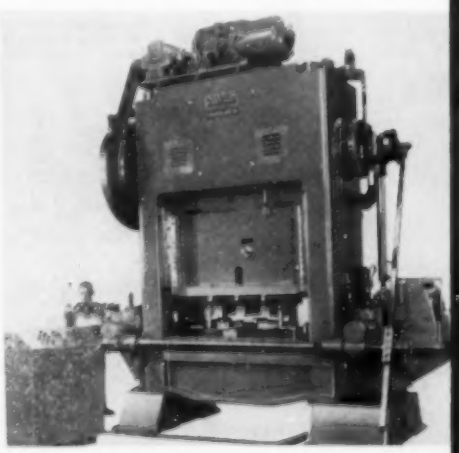
Fast cutting action and long wear qualities are characteristic of grinding wheels using IL Bond. The bond acts as an internal lubricant, increasing the abrasive cutting action of resinoid-bonded wheels.

Special chemicals and compounds are added to the wheel mix for resinoid bonds to create this new product.

Simonds Abrasive Co., Tacony and Fraley Sts., Philadelphia 37, Pa. **T-2-1642**

Press

A 200-ton high-speed Flexopress, with speeds up to 250 strokes per minute, is designed for minimum vibration. It also offers a high degree of vertical accuracy; bottom of ram is parallel to bed within 0.0005 in. Pre-loading and



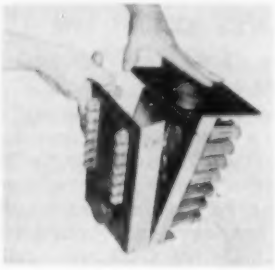
antifriction construction assure that this accuracy will be retained for the life of the machine.

Equipped with air friction type clutch and scrap cutter, the new Flexopress has double feed rolls mounted integrally for accurate stock feed. Powered by a 25 hp variable speed motor, the Flexopress features console control.

Precision Welder & Flexopress Corp., 3520 Ibsen Ave., Cincinnati 9, Ohio. **T-2-1651**

Package Controls

Designed with compactness so that they can be installed or adapted within limited space, these controls measure only 11 by 6 by 7 in. deep when closed and sealed. Called Directors, the units direct machines to perform various sequences of simultaneous functions to form complete cycles of operation. They



also may be employed to continually check on the performance of machine functions.

The units are built in hinged multi-deck form which makes all connections and components available for inspection and service.

The Directors are furnished as completely wired plug-in packages with wiring harnesses and terminals ready for connection to the machine motor controls and switches.

Sensory Inc., 504-252 Pleasantville, Rd., New Vernon, N. J. **T-2-1652**

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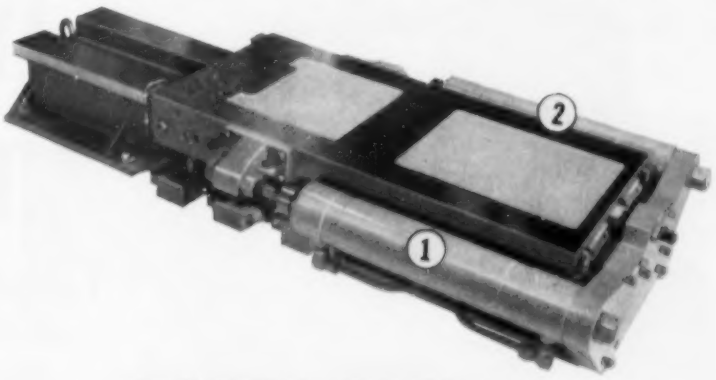
Adjustable Counterbore and Spotfacer

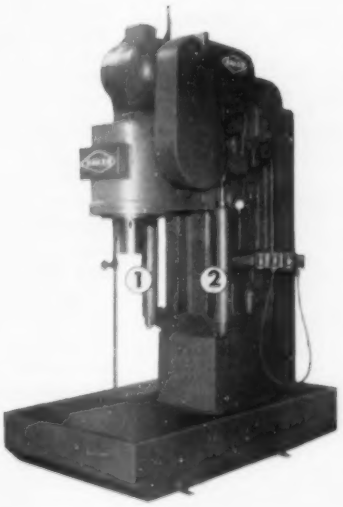
Two-bladed adjustable tool counterbores large diameters to precision tolerances and holds specific diameters even after numerous regrinds. It successfully spot-faces or counterbores steel forgings, heat treated steels, cast iron, titanium, stainless steel, aluminum alloys, etc. Choice of straight or tapered shanks permits use in radial drills, drill presses, turret lathes and milling machines. The M3 type high-speed steel blades are ad-

another BAKER bonus



TWIN PULL

. . . SERVICE IS A SNAP



Many reasons for Baker's twin pull hydraulic feed cylinders. They're out in the open . . . easily accessible for maintenance. Are more compact (3¼" diameter). Have adjustable chevron packing. And they're exclusive with Baker. Twin pull can be had on Baker specials — or on Baker Basics, for automation with *standard* machines.

BAKER AUTOMATION

Best in the long run
Practical in the short run

CHECK AND MAIL FOR DATA

( ) Twin pull hydraulic cylinders
( ) Flame-hardened, ground steel or cast iron ways — durable
( ) Separate Porta-Pak power feed unit — accessible for maintenance
( ) Big ball bearings throughout, rugged construction

BAKER BROTHERS, INC.
Dept. TE-257, Toledo 10, Ohio

Yes, tell me more about these Baker Bonuses . . .

NAME AND TITLE
COMPANY
ADDRESS
CITY ZONE STATE

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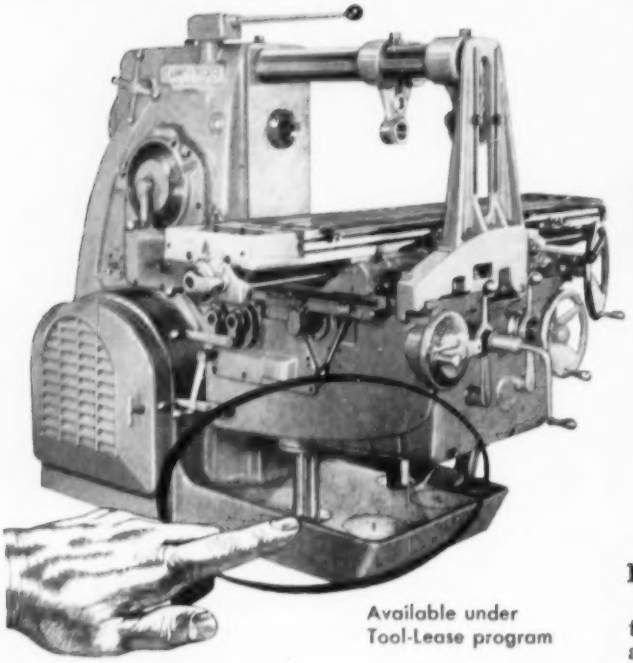
COMMON SENSE says it's better...



Available under Tool-Lease program

Twin Screw Knee Support

Think it over... twin screw knee support is the one really new basic advancement in knee type milling machine design in years. And only Kearney & Trecker new TF Series machines have it!

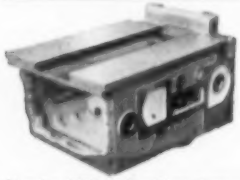
Here's why it makes sense.

Because the *twin screw* design distributes most effectively the weight of much larger, heavier knees, saddles and tables, it fulfills today's requirements for higher speeds, feeds and power — greater machine capacity. What's more, this *balanced design* substantially increases stability under heaviest loads... offers greater resistance to torsional thrust under all cuts... divides the wear factor in half, thus assuring greater, longer-lasting accuracy.

Kearney & Trecker's feature-packed TF Series line of general production machines is available in five sizes — No. 2 to No. 6, from 10hp to 50hp in Plain, Universal and Vertical styles.

Why take less than the latest when you want new milling machines? You can get all the facts on the new TF's from your Kearney & Trecker representative, or write direct to Kearney & Trecker Corp. Mail coupon for new catalog with details on TF Series machines.

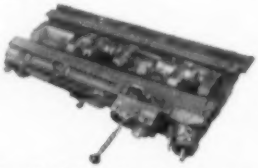
5 more reasons why TF Series milling machines are way out front in rigidity



Heavier, Wider, One-Piece Knee — The TWIN SCREW arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . lasting accuracy . . . substantial reduction of way and gib wear.

Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, flywheel, a train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life, better finish and quieter operation.

Double "Vibra-Void" Overarms — Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection than any other type support. Design also greatly simplifies changing of arbors and cutters.



"Fron-Trol" Operating Convenience — Front-mounted controls include feed selection, Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, table handwheel, saddle clamping gib and backlash eliminator. Machines have 2" dia. table feed screw.

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.

KEARNEY & TRECKER MILWAUKEE

BUILDERS OF PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

KEARNEY & TRECKER CORP.
6772 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on new line of TF Series Plain, Universal and Vertical milling machines.

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White Star Mach. Co.
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19 West 10th Street

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White Star Mach. Co.
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KEARNEY & TRECKER MILWAUKEE

justable laterally and are prevented from collapsing by set screws within the body at each blade end. No special grinding equipment is required and cutting angles of blades can be modified to best suit the material being machined.

Design is such that blades are positively locked in position and there is no tendency to rock or tilt. Blades are mounted ahead of center, producing a shearing action which rolls tightly

curled chips away from the pilot. This cutter location also minimizes chatter under heavy loads at wide blade extensions.

These tools are equipped to take standard pilots or can be used with stub drills. Replacement blades can be form ground by the user to meet special requirements. Five sizes available cover hole sizes from 1 in. to 4 in. OD. Larger sizes can be supplied on order.

Robert H. Clark Company, 9330 Santa Monica Blvd., Beverly Hills, Calif.

T-2-1671

Inspection Device

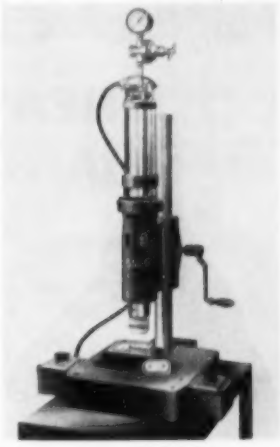
Convenient, high-speed inspection of finish and details on screw machine parts and similar work up to approximately 3 in. in diameter, are provided by this simple inspection device. Special lens permits quick focus on both large and small fields as well as flat and curved surfaces. Wide diameter of the lens allows both eyes to be used while critical inspection is made from all angles at casual distances from the lens. Light source for the unit, called the Spectifier, provides efficient and uniform illumination without variation on dull or bright days. Units are 6 x 7 x 9 in. high.

The Eastern Machine Screw Corp., New Haven, Conn. **T-2-1672**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Impact Bench Press

This Model 10 T Pneumark impact bench press is designed to stamp letters or numbers into steel parts. Die space in the tool can be changed quickly by means of handle at right side of column. Solid steel base is drilled and tapped



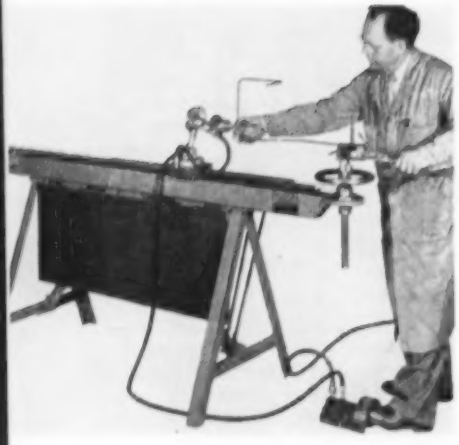
with six ½—13 holes for fastening fixtures or nests. Lettering tools use a 1-inch round shank.

Press is operated by means of solenoid-controlled valve, which opens only when both hand control buttons are pressed simultaneously.

Geo. T. Schmidt, Inc., 4100 Ravenswood Ave., Chicago 13, Ill. **T-2-1673**

Duplicating Bender

Operating solely on compressed air, this duplicating bender can be quickly set up to duplicate any bend from the template. After the required quantity of parts has been bent, the bender can be adjusted to duplicate the conditions of a second bend of the same tubing. This procedure is followed until the multiple number of bends required can all be made on a part in exact duplicate. The bender is customarily used on ¼ in. di-



ameter tubing having a wall thickness of 0.035 in.

The unit is designed to use three ball and socket units which enable a double backstop to be placed in any required position for locating one end of a tube at the beginning of a series of operations and then locating the same tubing in the vicinity of a previous bend for completing the several bending steps required on the part. A pneumatic foot valve clamps the ball and socket units.

After a tube has been bent to the requirement of the template, all subsequent tubes are bent without need for checking individual bends.

Complete bending head assembly is changed to accommodate variations in tube diameters and in bending radii. Ball and socket units may be conveniently moved along the 5-ft table to accommodate tubes of various lengths between bends.

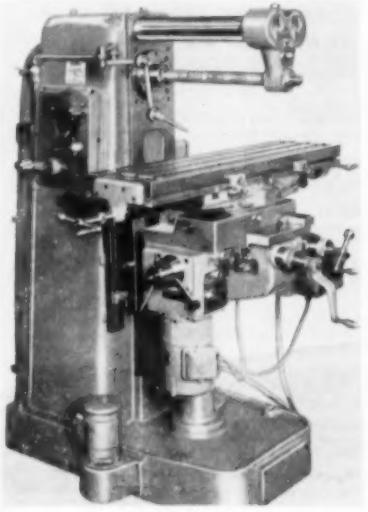
The Wallice Supplies Mfg. Co., 1304 Diversey Parkway, Chicago 14, Ill., manufactures the bender under license from the Northrop Co. **T-2-1681**

Horizontal Milling Unit

A geared-head horizontal milling machine, the Hero model 1C, available in both plain and universal types, is equipped with 12 spindle speeds from 35.5 to 1400 rpm.

The table of the universal model can be swivelled to 45 deg. left or right. A number of extra attachments makes the machine suitable for numerous milling uses. A double overarm gives max stability.

Pinion and bull gear on spindle have helical ground teeth, to insure freedom from vibration and noise. There are 6



high speeds through a special belt to eliminate chatter, and 6 low speeds directly through the gear train to give minimum driving torque to the cutter.

Speeds and feeds are read directly from large graduated dials. Push-buttons are within easy range of the operator for start, stop and inching.

Morey Machinery Co., 383 Lafayette St., New York 3, N. Y. **T-2-1682**

Internal Gages

Solid "Go" and "Not Go" internal gages, may be used as adjustable limit plug gages to check bore diameter, out-of-roundness and bell-mouth in any spot to a depth of as much as 5 in. Bores located one behind another, of equal or unequal diameters, can be checked

RUGGED

HEAVY-DUTY HAND CLAMPS

Knu-Vise offers rugged heavy-duty clamps, with solid bar or channel bar, and either hand or air operated, for all kinds of tough holding jobs.

In addition to their stand-up stamina for rough going, these Knu-Vise Clamps feature:

1—Easy and complete replaceability of parts
2—Hardened and ground bearing bolts
3—Minute adjustment of parts through self-locking nuts
4—Toggle Bars from C.R.S. Bars

Developments like these are typical of Lapeer engineering. More information? Write for catalog today on the models available.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

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WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

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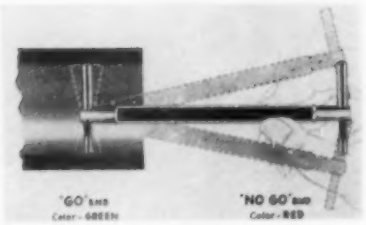


accurately. Holes requiring fine finish can be inspected without leaving marks. A full set of gages will cover a total Not Go end is red.

Single gages are obtainable. Handles are made of aluminum, assuring light weight to provide sensitive feel.

The Holojust is easy to adjust accurately and securely to any limits by means of micrometers or gage blocks.

Handles are colored for quick identification. The Go end is green and the Not Go end is red.

George Scherr Co., Inc., 200 Lafayette St., New York 12, N. Y. **T-2-1691**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Liquid Detergent

Concentrated liquid detergent, called Liqui-Det, goes into solution immediately, developing suds in hard or soft, hot or cold water. It penetrates and loosens the most common soils in a very short time. It can be used repeatedly on tile, asphalt or concrete floors without rinsing, and without causing any build-up of film or discoloration. It is safe on every type of surface. Concentrations as low as ¼ oz to the gal of water are used with satisfactory results.

Oakite Products, Inc., 158 Rector St., New York 6, N. Y. **T-2-1692**

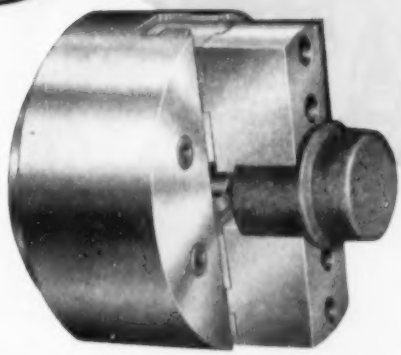
Barrel Finishing Equipment

Hot sawdust drying and polishing units and accessory equipment is available in three models (deluxe, standard and economy). Each of the units may be ordered separately as a barrel unit only, as a barrel unit with deluxe elevator refill (photo) or as a barrel unit with standard mechanical separator. The barrel, the same for all models, is 24 by 24 in., 5 cu ft capacity.

These units utilize power of a ¼ hp, 110 v, single phase gear motor with switch and gas venturi.

The deluxe elevator refill may be used with all three models or purchased as a separate accessory. This unit comes complete with top parts pan, a pneumatic vibrator separator, bottom storage pan and screw elevator for automatic barrel filling, with a ½ hp, 110 v single-

SP POWER CHUCKS



for more gripping power–
higher production

Famous S-P cam and lever design holds the work tighter, permits cost cutting heavy feeds and multiple cuts. S-P cam and lever design also resists opening of jaws by centrifugal force or diminishing air pressure . . . an important safety factor. Balanced for high rpm.

S-P SELF-CENTERING CHUCKS are built in Universal American Standard models, sizes 6" – 8" – 10" – 12", and Serrated models in 8" – 10" – 12" sizes. Two or three jaws.

S-P COMPENSATING CHUCKS grip out-of-round work with equal pressure on each jaw. Available in 8" – 10" – 12" sizes, two and three jaw models, American Standard or Serrated.

S-P ROTATING CYLINDERS

Air and Hydraulic

Adequate stroke for long jaw travel of S-P Chucks. Balanced for high rpm on machine tools and other applications. Details in Catalog No. 105 (Air) and Bul. 201 (Hydraulic).

S-P Power Chucks are installed as original equipment by Bardons & Oliver, Cleveland Automatic, Cone Automatic, Ex-Cell-O, Jones & Lamson, Monarch, Warner & Swasey . . . and many others. Representatives in principal cities. Prompt deliveries. Send for catalog No. 105. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio.

SPecify SP

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SOLON, OHIO • IN GREATER CLEVELAND
ESTABLISHED 1916 A BASSETT COMPANY

NON ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS
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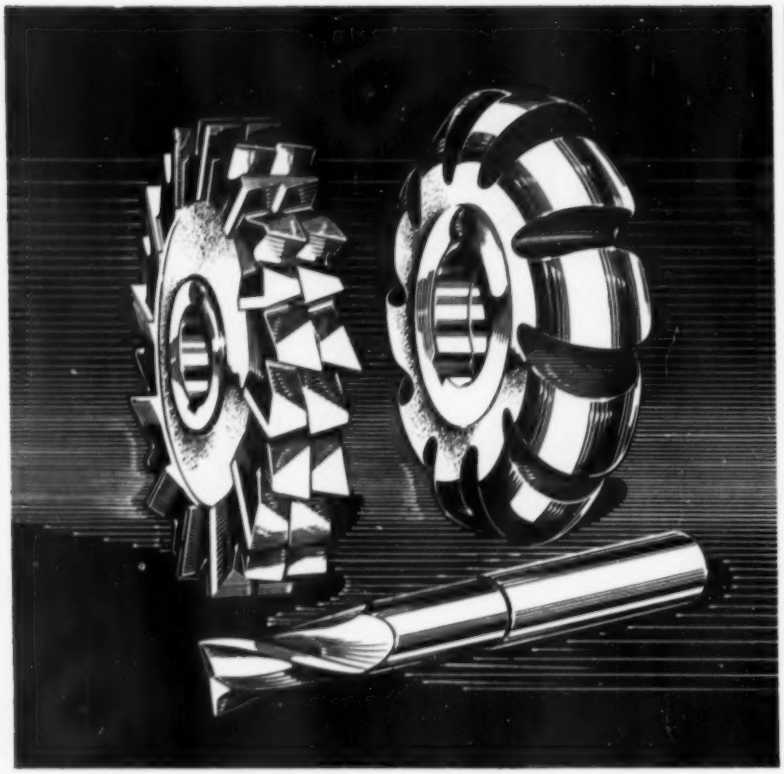

Are solid high-speed steel milling cutters obsolete?

If they are someone ought to tell our customers about it. They've asked us to produce so many styles and sizes that we finally went all the way and stock the most complete line available anywhere.

No, the solid high-speed steel cutters haven't been obsoleted by the carbides. When it comes to the smaller production runs and toolroom use, the solid steel cutters are *it*. Here, they'll perform more than adequately at the lowest possible initial tool cost. And they're much easier to maintain than the more costly carbide cutters.

Even though Go & Go produces a lot of inserted blade cutters, we're just as proud of our extensive line of solid high-speed steel cutters. Every tool is engineered with the same care and over 38 years of milling cutter know-how goes into each and every one.

Want to see the extensive stock of standards available? Ask for Catalog F, it's free on request. Go & Go also designs and manufactures special milling cutters in quantity. Check one of our engineering sales representatives in principal industrial centers for details.

Go & Go

GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

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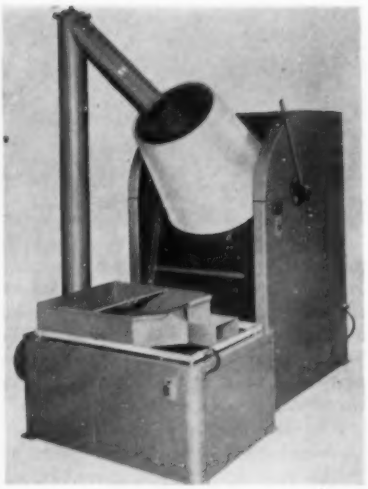
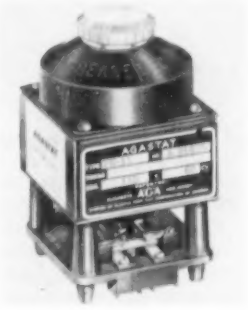


phase motor and switch. The standard mechanical separator, available as a separate unit or used in conjunction with the three models, comes complete with top parts pan, pneumatic vibrator separator and bottom sawdust storage bin. A complete line of door accessories and bound screens also is available.

Speed-D-Burr Corp., 3613 San Fernando Rd., Glendale 3, Calif. **T-2-1701**

Time-Delay Relays

Dial markings on the heads of these Agastat time-delay relays permit easy calibration and make the units particularly adaptable to applications requiring frequent time adjustments. Each dial is color coded to identify the tim-



ing range. Four timing ranges available in the dial head model are identified by: white, for time periods from 1/10 to 3 sec.; yellow, for 1/10 to 10 sec.; red, for 10 sec. to 2 min.; and blue for 30 sec. to 15 min. Each unit is adjustable within these timing ranges and the complete range is attained by one revolution of the dial.

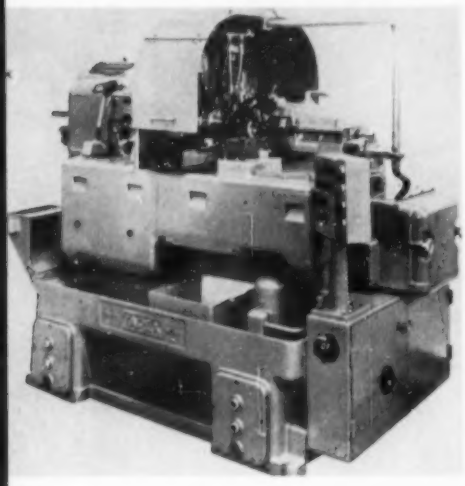
These relays are relatively unaffected by temperature changes from −65 to +160 F. They can be supplied for continuous a-c duty and for continuous or

intermittent d-c service. They are available for a-c operation at all standard voltages from 6 to 550 volts, 60 or 25 cycles. For d-c operation, they are made for all standard voltages from 6 to 230 volts.

Elastic Stop Nut Corp. of America, A'G'A Div., Elizabeth, N.J. **T-2-1711**

Single Spindle Automatic Lathe

Basic, fully integrated, single-spindle automatic turret lathe, called TAR/L Model, is designed and constructed on the unit system of interchangeability. For simple work, it is equipped with a minimum number of elements, while provision is made for addition of supplementary standard accessories and features without need for further fitting or scraping. Some of the standard units are: cam shaft accelerator for reducing nonproductive time; optional spindle speed nuts; universal spindle for either bar or chucking work, and either mechanical, hydraulic or pneumatic operation; single or compound front and rear slides; either one or two vertical slides; a choice of two types of single point thread chasing attachments and both types for either single or multiple starts; spindle brake with or without spindle positioning device; standard rear mounted work loading device with hand or magazine feeding; and high-speed drilling attachments.



The unit made by Tarex, S.A. is available in three sizes, having $1\frac{1}{4}$, $1\frac{5}{8}$ and $2\frac{1}{16}$ in. capacity. Max chucking diam is $4\frac{1}{2}$ in.; swing is 6 in.; and spindle speed ranges from 55 to 4730 rpm.

The lathe also can be supplied with either a six or eight-position turret and single or double indexing.

The drive to the headstock is by means of a gear train which can be disengaged to permit the spindle to be rotated freely by hand.

Independent motor drive of the cam shaft permits use of either high or low spindle speeds, in either direction, during the machining cycle.

Lever systems for all slides, except of the turret, are adjustable for ratio.

Distributed in the United States by Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y. **T-2-1712**

Sintered Iron

Low cost free-machining material, called Powdiron FM, is a pure sintered iron material with excellent machining properties.

In the illustration, a part made with Powdiron FM is compared with a part made from ordinary sintered iron, showing the superior machined finish of the Powdiron part.

In addition to its machining properties, the new material is readily avail-

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MORE TOOLS PER MAN FOR MORE PROFITS!

Even when labor was cheap and tools were costly, it was the best tooled shops that prospered. Now with wages higher and the work days shorter, it becomes imperative that every worker be supplied with every tool that will increase his hourly production.

See that each lathe, planer and shaper operator has the correct ARMSTRONG TOOL HOLDERS for each operation he performs. Equip each machine with its full complement of ARMSTRONG Setting-up Tools. Use better balanced, handier ARMSTRONG WRENCHES on machines and assembly lines. Specify ARMSTRONG Drop Forged "C" Clamps and Lathe Dogs . . . Today, only quality tools can be truly economical.

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ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5257 W. Armstrong Ave., Chicago 30, U. S. A.

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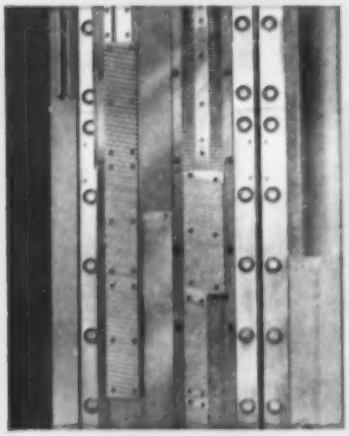
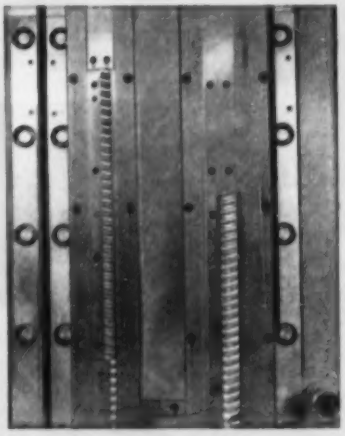
Here's how A. G. SPALDING & BROS.

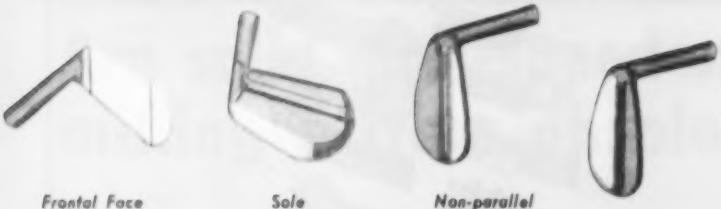
uses those good

LAPOINTE -BROACHES

to "up" their quality and slash production costs







Frontal Face *Sole* *Non-parallel cuts on back*

The fine finish you see on the surfaces of Spalding irons, No. 2 through No. 9, didn't get there just by chance! (*Fine finish is inevitable when using Lapointe-Broaches.*) **The perfect accuracy** of the machined surfaces, so necessary for obtaining the required balance and "feel" in matched sets, wasn't an accident either! (*Lapointe-Broaches are designed by capable engineers and ground by experienced craftsmen, so the accuracy of the broach is assured from the start.*) **The production economy** resulting from mass-precision Lapointe-Broaching was a real bonus on the deal . . . and particularly desirable in these times of rapidly rising shop costs.

We invite you to consider using *good broaches*, LAPOINTE-BROACHES, to drive down production costs.

LAPOINTE-BROACHES, *Electrolized* increase broach life between grinds from 2 to 10 times.

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HUDSON, MASSACHUSETTS — U. S. A.
In England, Watford, Hertfordshire
THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

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known to be the best in
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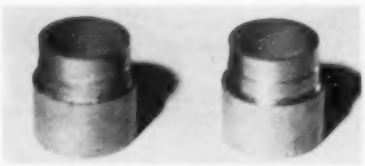

able, contains no added copper, has especially high ductility and provides long tool life.

Bound Brook Oil-Less Bearing Co., Bound Brook, N. J. **T-2-1721**

Torque Wrench Calibrator

Setting and checking of all types of hand torque wrenches is readily accomplished with this bench-mounted hydraulic torque calibrator. Completely self-contained, this calibrator requires no piping, wiring or other external connections. It is accurate within 1 percent

of the full-scale reading, and may be used to check both right and left-hand torque wrenches of flash, snap or dial types.

Model shown weighs 6 lb, is 7½ in. high and checks torque from 0 to 30 lb-ft. Other models are available for torques ranging from a few lb-in. to

Skidmore-Wilhelm Mfg. Co., 442 Green Rd., Cleveland 21, O. **T-2-1722**

Gage Attachment

Concentricity attachment is used in conjunction with the Bryant B-21 bench gage to check concentricity of small internal conical surfaces in relation to

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-2-175-1	Ace Drill Corp.	Carbide Drills—Catalog contains data on Ace "Ground-from-the-Solid" drills and hardened H.S.S. drill blanks. (Page 175)
A-2-50	Ace Drill Bushing Co., Inc.	Drill Bushings—Catalog contains technical data, comparison tables, price lists and name of nearest dealer. (Page 50)
A-2-279	Allegheny-Ludlum Steel Corp.	Tool Steels—Blue Sheet contains data collected in laboratory and field tests on Sagamore tool steel. (Page 279)
A-2-13	American Drill Bushing Co.	Drill Bushings—Catalog contains data on bushings and 3-D method of ordering. (Page 13)
A-2-232-1	Barksdale Valves	Air Valves—Bulletin A-5 contains data on 4-way air valve for 250 psi. (Page 232)
A-2-234-1	The Beckett-Harcum Co.	Control Valves—Catalog contains data on Hi-Cyclic valves. (Page 234)
A-2-263	The Blanchard Machine Co.	Grinding Wheels—Third edition of "The Art of Blanchard Surface Grinding" now available. (Page 263)
A-2-288	Brush Electronics Co.	Surface Finish—Surfindicator described in booklet. (Page 288)
A-2-158	Buck Tool Co.	Chucks—Catalog contains data on large universal scroll chucks. (Page 158)
A-2-177	Campbell Machine Div. American Chain & Cable	Special Machine—Campbell cutoff machines described in book. (Page 177)
A-2-290	Ciba Co., Inc., Plastics Div.	Plastics—Information on Ciba epoxy resins contained in catalogs for specific applications. (Page 290)
A-2-25	The Cincinnati Shaper Co.	Shapers—Write Dept. E for bulletin "Cincinnati Rigid Shapers." (Page 25)
A-2-163-2	Cramer Posture Chair Co., Inc.	Chairs—Hi-Model chairs for architects and engineers described in catalog. (Page 163)
A-2-291	Detroit Broach & Machine Co.	Broaching Machines—New bulletin contains data on Detroit vertical Pull Down machine. (Page 291)
A-2-208	H. E. Dickerman Mfg. Co.	Press Feeds—Engineering data on Dickerman hitch feeds and stock reels contained in catalogs. (Page 208)
A-2-238	The DoAll Co.	Gage Blocks—Catalog contains data on rectangular and square block sets and block accessories. (Page 238)
A-2-47	Eastman Kodak Co.	Projectors—Catalog contains list of representatives and description of Kodak contour projectors. (Page 47)
A-2-202	Eclipse Counterbore Co.	Cutting Tools—Engineering specifications contained in counterbore catalog No. 51 and end mill catalog No. 58 (Page 202)
A-2-35	Gisholt Machine Co.	Turret Lathes—Bulletin 1179 contains data on JETracer Fastermatic, automatic turret lathe. (Pages 34-35)
A-2-170	Goddard & Goddard Co.	Cutting Tools—Catalog F lists standards available and describes Go & Go designing service. (Page 170)
A-2-159	Hammond Machinery Builders, Inc.	Grinder—Catalog contains data on new Hammond electrolytic oscillating carbide tool grinder. (Page 159)
A-2-278	Handy & Harman	Brazing—Bulletin 20 gives facts on Easy-Flo applications. (Page 278)
A-2-158-1	Ideal Industries, Inc.	Centers—Catalog contains specifications on Gold Band Live Centers. (Page 158)
A-2-183	Jarvis Corp.	Tapping—Bulletin describes Jarvis adjustable pitch lead screw tapper. (Page 183)
A-2-235	Jones & Lamson Machine Co.	Turret Lathes—Folder No. 5440 describes J&L turret lathes. (Page 235)
A-2-299	W. B. Knight Machinery Co.	Milling Machines—Booklet contains information on new No. 60 vertical precision boring and milling machine. (Page 299)
A-2-157	Lamina Dies & Tools, Inc.	Press Supplies—Catalog contains information on guide pins and bushings for regular or special applications. (Page 157)
A-2-172	Lapointe Machine Tool Co.	Broaches—Booklet No. 1 "How to Care for Broaching Tools" now available. (Page 172)
A-2-226	Lepel High Frequency Laboratories, Inc.	Induction Heating—Catalog contains data on Lepel induction heating applications. (Page 226)
A-2-234-3	Lovejoy Tool Co., Inc.	Cutting Tools—Catalog No. 31 contains data on face mills; No. 32, on side mills; and No. 33, on arbors. (Page 234)
A-2-249	Madison Industries, Inc.	Cutting Tools—Madison rough and finish boring tools described in catalog. (Page 249)

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-2-242	M.B.I. Export & Import, Ltd.	**Jig Borer**—Operational data on Dixi 60 horizontal optical jig borer available upon request. (Page 242)
A-2-262-3	W. F. Meyers Co., Inc.	**Cutting Tools**—Catalog 52 contains data on "Meyco" carbide saws and cutters. (Page 262)
A-2-244-4	The Middlestadt Machine Co.	**Tools and Dies**—Brochure describes Middlestadt engineering services and special machinery. (Page 244)
A-2-307	Mohawk Tools, Inc.	**Cutting Tools**—Mohawk Subland tool catalog describes Sublands vs. Step Tool operations. (Page 307)
A-2-220	New Hermes Engraving Machine Corp.	**Special Machines**—Catalog H-B-11 describes pneumatic attachment for New Hermes Engravograph. (Page 220)
A-2-271	New York Belting & Packing Co.	**Belt Drive**—Engineering specifications contained in the Gilmer "Timing" Belt Stock Drives Manual. (Page 271)
A-2-246	C. A. Norgren Co.	**Air Control**—New catalog contains data on Norgren Air Line Filters and Pressure Regulators. (Page 246)
A-2-74	The Ohio Crankshaft Co.	**Induction Hardening**—"Typical Results of TOCCO Induction Hardening and Heat Treating" available in catalog form. (Page 74)
A-2-231	The Ohio Knife Co.	**Wear Plates**—OK Catalog contains data on aluminum bronze wear plates. (Page 231)
A-2-181	Optical Gaging Products, Inc.	**Surface Inspection**—Micro-Gage Charts described in bulletin. (Page 181)
A-2-154	Perry Equipment & Engineering Co.	**Machine Attachments**—Bulletin No. 536 contains data on Pesco vibratory part feeders. (Page 154)
A-2-293	Putnam Tool Co.	**Cutting Tools**—Putnam catalog fits in machinist's tool box for easy and quick reference on the Putnam line of cutting tools. (Page 293)
A-2-308-3	R. B. Tool Co., Inc.	**Cutting Tools**—Catalog contains data on R.B. threading tools. (Page 308)
A-2-55	R and L Tools	**Cutting Tools**—New catalog contains data on R and L tools. (Page 55)
A-2-252	Rivett Lathe & Grinder, Inc.	**Valves**—Catalog 204 gives circuit design drawings, specifications, cut-away views, tables, diagrams of Rivett valve with floating piston. (Page 252)
A-2-10	The Rotor Tool Co.	**Air Tools**—Rotor J-2-L impact wrench described in Bulletin 41. (Page 10)
A-2-232-2	George Scherr Co., Inc.	**Microscope**—Toolmaker's microscope described in catalog. (Page 232)
A-2-38	Seibert & Sons, Inc.	**Control Systems**—Circular B-10 contains data on Seibert tool control systems. (Page 38)
A-2-260	The Sidney Machine Tool Co.	**Lathe Attachments**—Bulletin contains engineering specifications on Sidney fluid tracer head. (Page 260)
A-2-189	The S-P Mfg. Corp.	**Chucks**—Details on S-P power chucks in Catalog No. 105 for air and Bulletin No. 201 for hydraulic. (Page 189)
A-2-200-2	Standard Parts Co.	**Fixture Components**—Illustrated catalog describes jig and fixture components. (Page 200)
A-2-309	Stupakoff Div. of The Carborundum Co.	**Cutting Tools**—Catalog contains data on case histories, engineering specifications on Stupalox oxide cutting tools. (Page 309)
A-2-192	Syntron Co.	**Machine Attachments**—Catalog contains data on Syntron vertical vibratory parts feeders. (Page 192)
A-2-306	Taft-Peirce Mfg. Co.	**Gages**—Catalog No. 613 contains data on Comp-U-tair airgage. (Page 306)
A-2-272	The Torrington Co.	**Special Machines**—Catalog contains data on Torrington Rotary Swaging Machines. Also available, 20-minute, full-color film on swaging. (Page 272)
A-2-292	Vlier Engineering, Inc.	**Machine Accessories**—New catalog shows applications for Vlier tooling accessories. (Page 292)
A-2-69	Walker Turner Div. of Rockwell Mfg. Co.	**Grinders**—Booklet contains data on Walker-Turner grinders. (Pages 68-69)
A-2-282-2	West Point Mfg. Co.	**Hold-down Clamps**—Bulletin and also template sheets available for work-holding toggle clamps. (Page 282)
A-2-276-4	Woodson Tool Co.	**Cutting Tools**—Catalog contains data on micro miniatures. (Page 276)
A-2-193-1	The Yoder Co.	**Slitters**—Slitter operation and economics, time studies, cost analyses and other useful data contained in new Yoder slitter book. (Page 193)
A-2-194	Zagar Inc.	**Drill Heads**—Drilling applications described in Zagar's engineering data sheets. (Page 194)

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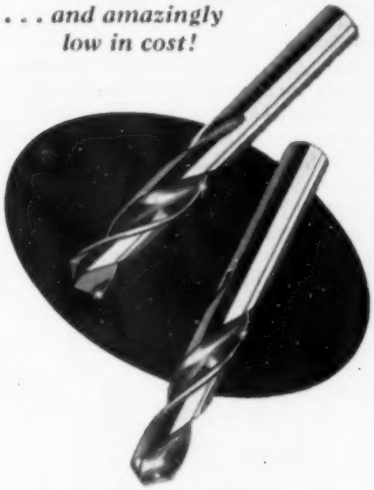

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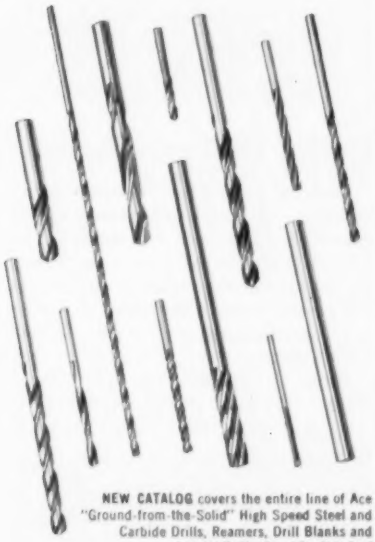


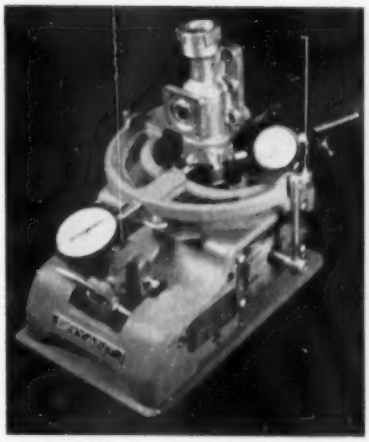
NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL

ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

INDICATE A-2-175-1



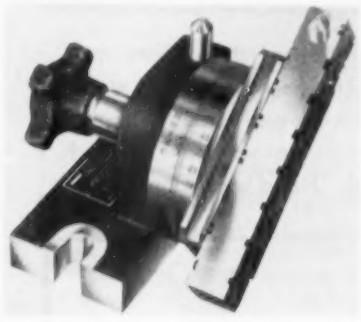
a thread.

In the illustration, an internal conical surface approximately ¾ in. in diameter and 1/16 in. wide is being checked in relation to a 1 9/16-12 internal thread. Size of the internal thread is checked at the same time.

Bryant Gage & Spindle Div., Box 620, Springfield, Vt. **T-2-1751**

Angle Dresser and Toolholder

This double duty tool, called the G2, is designed to incorporate the function of an angle dresser and a toolholder in a single tool. It has an easy-to-read



vernier scale of 0 to 180 deg which assures accuracy within 2 min. of 1 deg. It is particularly useful in setting up small jobs to be milled, drilled, tapped, etc. at any desired angle.

Rothfuss Tool Co., Box 2804, Providence 7, R. I. **T-2-1752**

Template Printer

Master layouts and templates are made on a production line basis by photographic methods on this contact printer. The machine is equipped with two closing lids, each 180 in. long, which can be raised and lowered together if a template over 15 ft long is being made.

Special Size Reamers ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ... AT NO EXTRA COST!

DOWEL PIN REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .1230 thru .4995" Sets, tool

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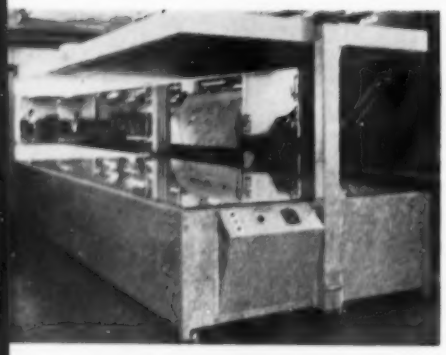
CHICOPEE, MASS.

INDICATE A-2-175-2



Or, if one smaller than 15 ft is to be produced, one half of the machine can be used while the other half is idle.

A template can be made by this machine in a matter of minutes. Printers are available in sizes from 38 x 50 in. to 72 x 360 in. Light is provided by special fluorescent tubes.

Miller-Trojan Co., Inc., Troy, Ohio.

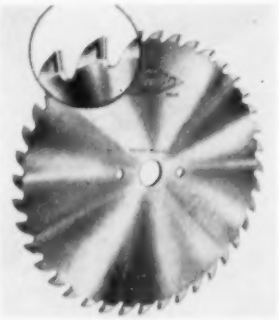
T-2-1761

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbide Tipped Saw

This circular blade saw incorporates a Penta-Cut carbide tooth design developed for cutting nonferrous metals. The patented carbide tips are of alternate design (male and female) so as to provide a group of five cutting edges in every set of two teeth. The male tooth in the set has a slightly wider kerf to provide a planing or shaving action on the side of the material as the saw cuts.

The tooth design provides cool, clean



cutting without gumming or burning of materials. Chip disposal is easy and quick. There are no burrs on cut edges. Maintenance requirements for saw blades are minimized. Because all cutting edges are on the same periphery, this saw can be sharpened precisely on a machine. No special setups are required.

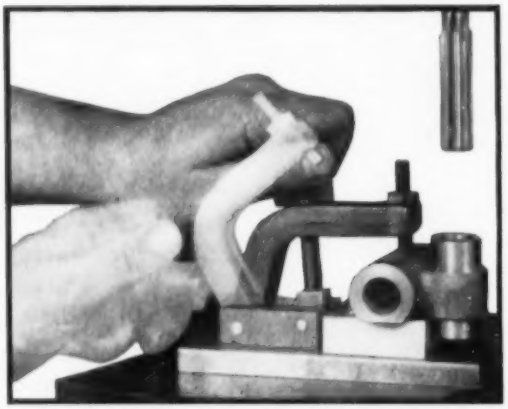
Carbide Penta-Cut tooth saw blades are available in 12, 16, 18 and 20 in. diam.

Victory Carbide Saw & Tool Co., 3856 N. Ashland Ave., Chicago 13, Ill.

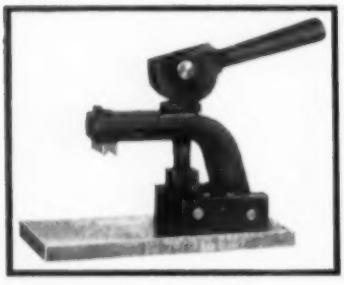
T-2-1762

Fast and Sure Clamping
LODDING Retracting Clamps

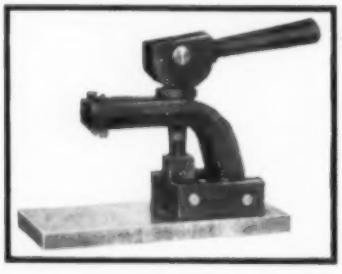
Air automation, too—as fast as your air line—absolutely rigid—self retracting



As quick as your hand, a quarter turn of the screw—one movement of your arm—and your Lodding Clamp is at work. Another simple movement releases work and retracts Clamp. Here is complete surety and quick action—a time and cost saver. Four sizes each of four styles. Hand knob, cam or nut.



Block Adaptor



Round Adaptor

Mounting holes for easy adaptor installation

Factory Warehouse

Precision Tool Sales, 417 E. Florence Ave.
Los Angeles 3 — PL 3-3321

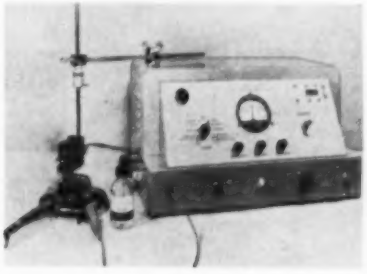
LODDING, Inc., Worcester 1, Mass.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-176

Plating Thickness Tester

Model 955 electronic thickness tester measures thickness of platings and metallic coatings such as decorative and heavy chromium, silver, tin, cadmium, zinc, copper, brass, nickel, lead, lead-tin, and tin-zinc alloy. Base material can be steel, copper, brass, aluminum and other metals, ceramics, and plastics.

Simple to operate, the tester incorporates a constant pressure device which



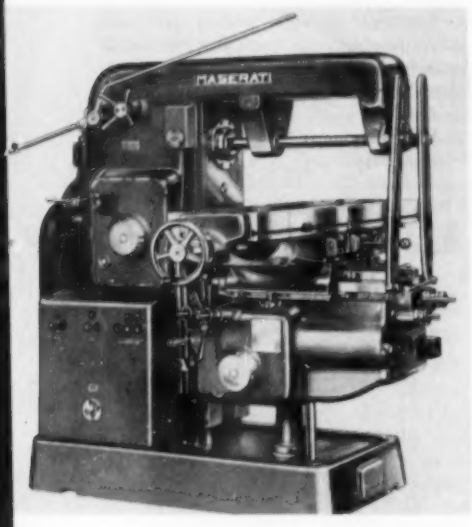
automatically maintains uniform pressure between test cell and specimen, so there is no need to rely on operator judgment alone.

Accuracy of the instrument can be checked at any time, and a calibration adjustment will automatically correct high or low readings.

Kocour Company, Dept. K-2, 4800 S. St. Louis Ave., Chicago, Ill. **T-2-1771**

Milling Machine

This Model #3 horizontal and vertical milling machine, built by Maserati Machine Works in Italy, has a table working surface of 59 by 13 25/32 in. Three table slots have widths of 0.7086 in.; distance between slots is 3.1495 in. The universal table swivels 45 deg. Spindle taper is 2¾ in. Maximum dis-



tance from center of spindle to top of table is 18¼ in. Maximum diam of cutter is 12⅝ in.

The unit has power rapid traverses in all directions, dual automatic selection of speeds and feeds, dual controls for all power feeds and rapid traverses, and dual controls for clutch and brake.

Maserati Corp. of America, Westbury, L.I., N. Y. **T-2-1772**

Die Casting Machines

Designed for fast production, the Unicaster Model 120, 450-ton capacity die casting machine incorporates a simplified, compact and self-contained hydraulic system mounted on a sub-base of the machine. There are no pilot lines, and couplings of all hydraulic pipes have welded flange fittings to avoid oil leaks or hydraulic shock.

Tank cleanout is simplified because of easily accessible oil filters; tank

Abrasive Cutting

the best way to cut many materials
the only way to cut some

Campbell Cut-Off Machines

Rough, serrated cut of metal saw

Smooth-finished cut of CAMPBELL Abrasive Cut-Off Machine with ALLISON Wheel

Smooth cutting saves grinding operation for American Gear & Mfg Co.

Cross sections of gear teeth—smooth, fine-finished and ready for metallurgical study—save an entire extra grinding operation at the Lemont, Illinois plant of American Gear & Mfg. Co., a division of Brad Foote Gear Company.

These test samples are neatly "sliced" down to a single gear tooth in thickness on a CAMPBELL 406 Oscillating Wet Abrasive Cut-Off Machine, equipped with just the right ALLISON Abrasive Wheel for the job. These sections with fine finish, no hard spots, no change in metallurgical characteristics, come from the WET cut with abundant coolant applied just where it does the most good. It's the OSCILLATION of the abrasive wheel... the right one for the job... that handles big cuts like this with speed and economy.

Examples of Economy Abrasive Cutting gives

A large aircraft manufacturer reports CAMPBELL Abrasive Cut-Off Machines cut stainless steel tube twice as fast as other methods—saving $32,000 in the first year of operation.

International Nickel's tough K Monel, 4¾" dia., is cut in 2 minutes per cut on a CAMPBELL Oscillating Wet Abrasive Cut-Off Machine.

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What is your metal cutting problem? Does it involve cutting of alloy or high carbon steel? Our Field Engineers, abrasive cutting specialists, can help you arrive at that particular combination of CAMPBELL Cut-Off Machine and ALLISON Cutting Wheel that will improve your operation and save you money.

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THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

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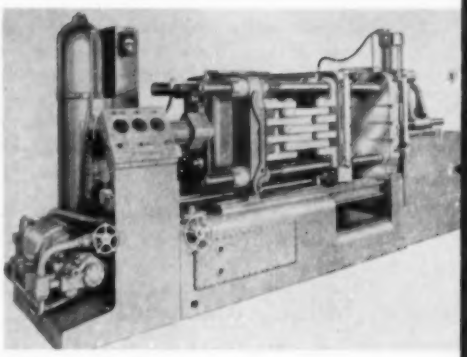


drainage is not necessary. For easy maintenance all four of the tie bars can be pulled without dismantling any part of the machine.

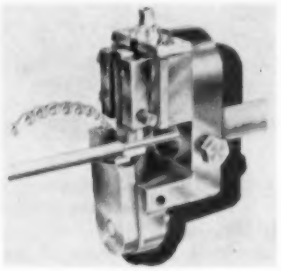
Shot end design also has been simplified with an unusual adjustment device. Only two nuts are used for final clamping of nozzle to die.

Electrical controls permit operation of equipment on automatic cycle or manual. All hydraulic control valves are located within easy reach of the operator.

Unit Products, Div. of Uniloy Corp., Saline, Mich. **T-2-1781**

Box Tool

Box tool incorporates fine adjustment for the cutter, facilitating setup and adjustment of tool bits. Carbide



tipped backrests have built-in coolant tubes. Tool holder can be used for both left and right hand turning.

R. B. Tool Co., 785 N. Broadway, White Plains, N. Y. **T-2-1782**

Optical Comparator

This 8 in. optical comparator is designed to utilize vertical beam of light, so that the work stage is in a horizontal plane. With this design work is simply laid on the stage and measurements in both dimensions are obtained in natural motions from left to right or front to rear.

The unit has a quick-indexing objective turret for 10x, 20x and 50x mag-

nification, a retractable vertical illuminator for reflected images in all 3 magnifications, selective filter for increase of contrast in transmitted as well as reflected light, a rapid-acting 2-dimensional stage for locating work against charts and a rotating circular screen for angular measurements.

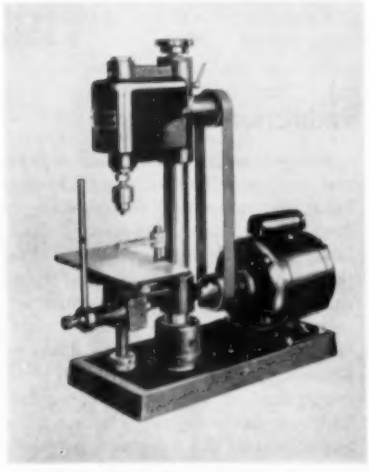
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y. **T-2-1791**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tapping Machine

This tapping unit incorporates a special homing device to simplify precision tapping operations and avoid risk of tap breakage and work damage. It will precision-tap thin sheets without stripping and tap brittle plastics without chipping. Blind holes can be tapped to the bottom without risk of breaking the tap.

With the homing device, the tapping machine spindle is returned to neutral automatically when pressure on the



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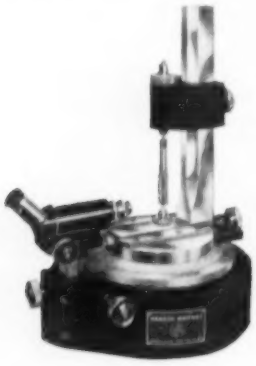
Thread Comparator (Internal) with Concentricity Attachment

Thread Comparator Standard Model



Optical Tap Checker

Thread Comparator (External) with Squareness Attachment

Tap Check Comparator

WHERE QUALITY BEGINS . . .

Hanson-Whitney offers your production the utmost protection with a complete line of master precision instruments for inspection of screw thread having closest tolerances. Each an addition to the traditionally fine line of H-W taps, gages, hobs, and cutters . . . these H-W gages assure "full quality control from thread start to finish."

Hanson-Whitney's entire line of products are designed and manufactured with "single source integrity" . . . key factor in accuracy and availability. Local distributors back Hanson-Whitney's home and field engineering with complete stocks for fast, off-the-shelf service. Write for free literature.

Hanson-Whitney COMPANY

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TAPS : THREAD GAGES : HOBS : CENTERING MACHINES : THREAD MILLING MACHINES AND CUTTERS
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-180

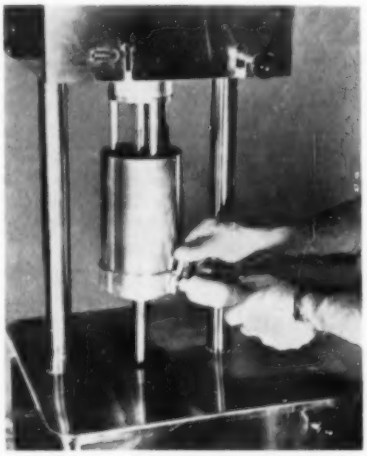
feed lever is released. Return to neutral stops rotation of the tap and permits easy withdrawal through reverse pressure on the feed lever. Capacity of the unit ranges from 0.034 in. x 120 to 0.25 in. x 24.

The Hamilton Tool Co., Ninth St. at Hanover, Hamilton, Ohio. **T-2-1801**

Pressure Mixer

Available in five models, from one quart laboratory mixer to five quarts production mixer, this Semco pressure mixer is designed for blending catalyst and additive materials in a container in a manner which assures that the mix delivered will be air-free.

As much as a quart of base material may be mixed in a few minutes and the mix delivered, while still under pressure, into a polyethylene cartridge. Action of mixer is provided by two double acting air cylinders. A counter registers the dasher cycles assuring uniformity of batches.



The cabinet and pots are stainless steel. Pot and dasher readily disassemble for easy cleaning.

Pyles Industries, Inc., 8926 Second Ave., Detroit 2, Mich. **T-2-1802**

Induction Heater

Bench-mounted 2-kw induction heater can be used for soldering, brazing, hardening, annealing and similar production operations. Designated Model L6E, it has a built-in output transformer for matching a variety of load shapes and sizes; a built-in automatic recycling heat cycle timer; circuit breaker protection of both line and high-voltage circuits, outlet for interconnection of remote switches, turntables or other fixture interlocks; water-cooled coil and transformer circuits;

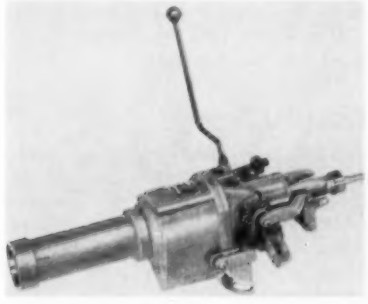
and a forced air cooling system.

The unit weighs approximately 200 lb and measures 28 in. high, 25 in. wide and 18 in. deep. It can be supplied with custom tooling.

Reeve Electronics, Inc., 609 West Lake St., Chicago 6, Ill. **T-2-1811**

Lead Screw Tapper

Adjustable pitch lead screw tapper requires only one lead screw to cut all listed pitches. Available in two models, the AP 9100 allows conversion from 11 pitch to 12, 13, 14, 16, 18, 20, 24 and 28 pitch in a matter of seconds. Model AP



9000 converts from 24 pitch threads to 28, 32, 36, 40, 44, 48, 56, 64, 72, and 80 pitch.

A graduated scale, indicating pitch settings, is attached to a lever which controls the vertical travel of the lead screw follower and the tap.

Jarvis Corp., Middletown, Conn. **T-2-1812**

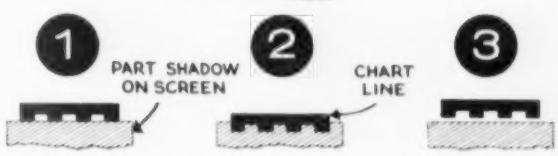
Hole-Grinding Burs

The 1903 series of miniature hole-grinding burs will grind extremely small holes in hardened steel up to 64 R_C. There are 17 different tools in this series, all on $\frac{1}{8}$-in. shank.

The miniature hole grinding bur removes up to 0.006 and 0.008 stock with a finish of 2 microinch or better. Rec-

TEST YOURSELF

on gaging a split thousandth



(See correct answers below)

This is only *one* type of standard O.G.P. Micro-Gage Chart Line used for quick checking of close tolerances on your optical comparator. Micro-Gage Charts are an optical adaptation of the toolmaker's way of checking his work by comparing it to a straight edge against the light. A crack of light is easy to see . . . much easier than trying to guess whether a part shadow coincides with or falls between parallel lines on a chart. That's why O.G.P. Micro-Gage Charts, printed from precision-scribed masters, permit lower magnification, thus often eliminate costly mechanical shifts in your fixtures. Operators report: (1) Improved accuracy; (2) faster checking; (3) Less indecision. Our experience can help you determine *when* to use Micro-Gage Charts and *which* type will best suit your job.

EVERYTHING TO MAKE YOUR OPTICAL COMPARATORS MORE USEFUL

We also supply all types of standard charts, custom charts, layout accessories, fixture bases, and custom fixtures to meet your specialized requirements.

Answers to above test:

1. Part acceptable. 2. Part oversize. 3. Part undersize.

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ommended speed is 100,000 rpm or better. The tools will not load, create little or no heat, and prevent distortion in piece parts. They can be resharpened in the spindle with a diamond hone.

The Atrax Co., Newington, Conn.

T-2-1821

Screwdrivers and Nutsetters

Air and electric screwdrivers and nutsetters make possible precision torque control in the assembly of threaded fasteners. The tools may be used satisfactorily by inexperienced assemblers.

The line, identified as Thor Uni-Tork, incorporates a torque adjustment which is set on the outside of the special clutch attachment. The clutch disengages instantly and completely when the

preset torque is reached. The cycle is snap-action, with no ratcheting, slipping or buzzing of the clutch jaws. The torque setting holds indefinitely, assuring uniform tightness and quality in the assembled product. Range of adjustments is from 10 to 100 in.-lb torque.

The Uni-Tork tools are available in 18 models in Thor's No. 2 and 22 air tool line, including eight reversible machines.

The Uni-Tork clutch attachment is also available in four models of the Thor universal electric Silver Line series of screwdrivers and nutsetters.

Thor Power Tool Co., Aurora, Ill.

T-2-1822

Circular Saw

This metal-cutting circular saw makes accurate straight and mitre cuts in either tubes or bar stock. It is available in two sizes for cutting up to 2⅜ or 3½-in. bar stock respectively. The unit, which is easily portable, is of simple, strong construction. All parts are interchangeable.

Wandsbeker Werkzeug Gesellschaft, 124. Beinhoff & Co., Konigsreihe 14-16, Hamburg-Wandsbek, Germany.

T-2-1823

Blower Motor

Power output of these totally enclosed a-c motors can be increased without exceeding the rated temperature rise of the motor because the motor is cooled by air from the blower it powers. The motors have cast-iron ribbed frame construction, oversized double-shielded ball bearings, and metermatic lubrication with automatic grease relief. Heavy Formvar nylon-coated magnet wire is used for coils, with six coats of special insulating varnish.

To simplify connection, leads are

42" DRILL JIG WITH 140-HOLE PATTERN HELD WITHIN ± .0005" BORING TOLERANCE

In contracting with Mechanical Specialties Co. for this complicated drill jig, Hughes Aircraft specified Pioneer 921-T to insure dimensional stability. Boring of the drill bushing pattern was held well within the .0005" tolerance allowed. Absolutely no distortion or movement occurred after the finish machining operation. You are safe with 921-T.

921-T GIVES YOU THESE ADVANTAGES

Pioneer 921-T reduces tooling costs because it is easily sawed, tapped, milled or welded. Being 100% stable, with high tensile strength and ⅓ the weight of tool steel, 921-T meets every precision tooling requirement at lower cost. Its specialized alloy composition and method of manufacture guarantee absolute uniformity and insure against porosity, distortion and casting defects. Consult the Pioneer supplier nearest you, or write for complete information, catalog and case histories of 921-T usage in tooling operations such as yours.

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Warehouses: Grand Rapids, Mich.; Elkhart, Ind.; Cleveland, Ohio
Meier Brass & Aluminum Co.
1471 E. Nine Mile Road, Hazel Park, Mich.
Pioneer Sales Engineering
2233 Inkster Road, Inkster, Mich.
Joseph T. Ryerson & Son, Inc.
16th and Rockwell Sts., Chicago, Illinois
Joseph T. Ryerson & Son, Inc.
60 Everett St., Boston, Mass.
Joseph T. Ryerson & Son, Inc.
Milwaukee, Wis.
Southern States Iron Roofing Co.
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Warehouses: Atlanta, Ga.; Birmingham, Ala.; Louisville, Ky.; Memphis, Tenn.; Miami, Fla.; Nashville, Tenn.; Raleigh, N.C.; Richmond, Va.
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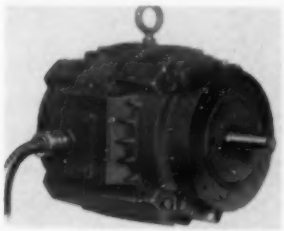
EXTRUSIONS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-182

numbered and indexed through a neoprene gasket between the frame and conduit box, with the indexing corresponding to the connection diagram on the nameplate. The motors are available in NEMA frame sizes from ½



through 30 hp and may be operated on 208-v network systems.

Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio. **T-2-1831**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Relief Grinder

Cam-actuated fixture for relief grinding of step drills, countersinks, taps, etc., uses a single solid cam for infinite adjustment of clearance lift. Index hubs contain indexes for different numbers of flutes, which can be slipped on or

off in a few seconds. An extended spindle in rear permits addition of pulley to motorize the tool. The unit uses 5-C collets. Its base is graduated to 360 deg. Spindle locks by a simple twist.

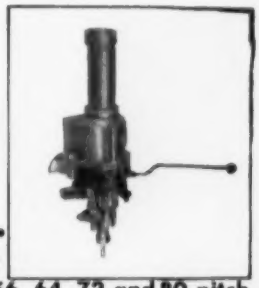
Steptool Co., 3613 E. Olympic Blvd., Los Angeles 23, Calif. **T-2-1832**

Hydraulic Mill for Aluminum

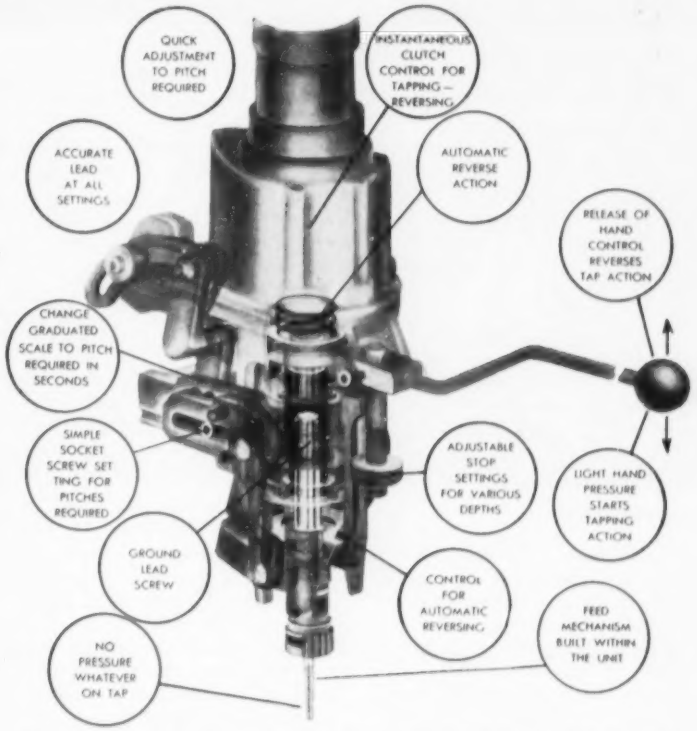
This hydraulic planer-type mill can be furnished in heights of 30, 36 and 43 in. widths of 30 or 36 in. and with stroke lengths of 6, 8 or 10 ft. Hydraulic equipment and electrical equipment

NEW Jarvis adjustable pitch LEAD SCREW TAPPER!

2 models. . .



Convertible to 11, 12, 13, 14, 16 18, 20, 24 and 28 pitch . . . 24, 28, 32, 36, 40, 44, 48, 56, 64, 72 and 80 pitch in SECONDS!


QUICK ADJUSTMENT TO PITCH REQUIRED
INSTANTANEOUS CLUTCH CONTROL FOR TAPPING—REVERSING
ACCURATE LEAD AT ALL SETTINGS
AUTOMATIC REVERSE ACTION
RELEASE OF HAND CONTROL REVERSES TAP ACTION
CHANGE GRADUATED SCALE TO PITCH REQUIRED IN SECONDS
SIMPLE SOCKET SCREW SETTING FOR PITCHES REQUIRED
ADJUSTABLE STOP SETTINGS FOR VARIOUS DEPTHS
LIGHT HAND PRESSURE STARTS TAPPING ACTION
GROUND LEAD SCREW
CONTROL FOR AUTOMATIC REVERSING
FEED MECHANISM BUILT WITHIN THE UNIT
NO PRESSURE WHATEVER ON TAP

Now, one attachment, one lead screw with quick simple adjustment gives convertible tapping in Seconds! Through positive leverage and clutch control, one lead screw running at constant speed, makes these new adjustable pitch lead screw tappers a must in every tapping department.

This is production economy—saves the cost of individual lead screws for each pitch desired. Saves change over time—converts in a few seconds—by adjustment of four set-screws along a clearly marked graduated scale.

Tap with a feather touch on hand control . . . no pressure on the tap. Stops cut at end of predetermined depth. Automatically reverses upon release of hand control, automatically backs out, leaving clean, accurate threads.

Now, convertible pitch tapping, faster production, new versatility is assured even by unskilled operators—with this tapping attachment.

WRITE NOW!
Send for bulletin and prices.

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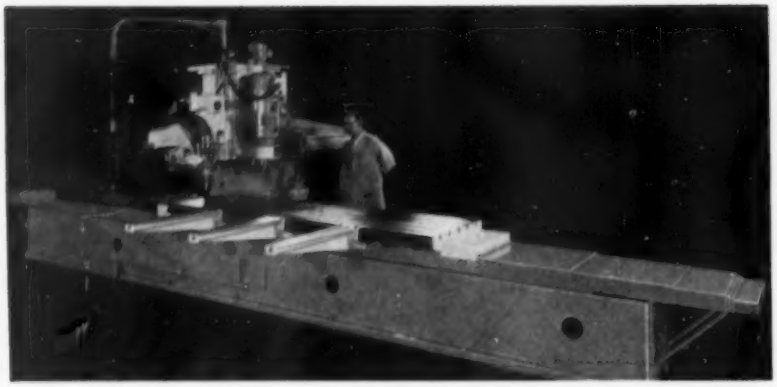

are interlocked for safety protection for operator and work.

Bed and table ways have been designed especially for tracer-milling control. Full rated stroke of the machine is available for all lengths. As maximum stylus-tool adjustment is also the rated width of the machine, a subplate or extension bars are required to carry the master when machining a workpiece as wide as the table.

The 7½ hp hydraulic power unit employs tandem-mounted pumps; one for cross and longitudinal movement, and one for vertical movement.

The milling head is extra equipment and a 15/30 hp 1800/3600 rpm high-speed milling head is shown in the illustration.

A three-dimensional tracer valve is mounted on adjustable slides for longitudinal, cross and vertical adjustments for varying the relationship between cutter and stylus. An additional tracer valve, arranged with a four position turret stop, is provided for variable depth control for 360 deg contour operations. A button on the control pendant selects which valve is to be used.

Rockford Machine Tool Co., Dept Z, 2500 Kishwaukee St., Rockford, Ill.

T-2-1841

Tracer Lathe

Hydraulic multi-cycle tracer lathe, Model 14T, permits fast, economical machining of irregular shapes. Only one template is required for multi-cycle cuts. Two roughing cuts, a semi-finish and finish cut can be accomplished in one automatic cycle. An indexing turret permits the use of two cutting tools, one for roughing and one for finishing. Shiulder facing tools can be provided.

The stylus, template and workpiece can be seen from the operator's normal position. The unit is loaded from the front. Tracer controls and stylus are on the top carriage so chips and dirt will not accumulate on the template. Ample chip room is provided, with provision for automatic chip removal if desired.

The transmission type heads are available with 2, 4, or 8 speeds. Automatic speed changes are provided for all cuts of a cycle with each type head. Proper spindle speed for the best surface finish and feed are automatically maintained.

A direct reading scale is provided for positioning of the tailstock.

Sundstrand Machine Tool Co., Rockford, Ill. **T-2-1842**

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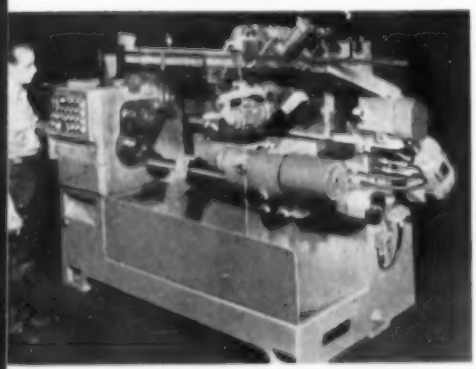

Bar Automatic

This 7/16 in. RA-6 multiple spindle bar automatic for manufacture of small, high-production parts, measures approximately 5 ft high, and 5½ ft long without the stock reel.

Spindle speeds up to 4500 rpm are available in standard models. Models equipped with spindle stopping mechanisms have speeds to 3200 rpm. Spindle capacity is 7/16 in. using standard collet and pusher tubes and can be increased to accommodate ½ in. round or 7/16 in. hexagonal stock by using combined pushers and pusher tubes.

The toolslide is of the standard Acme-Gridley flat surface design with center

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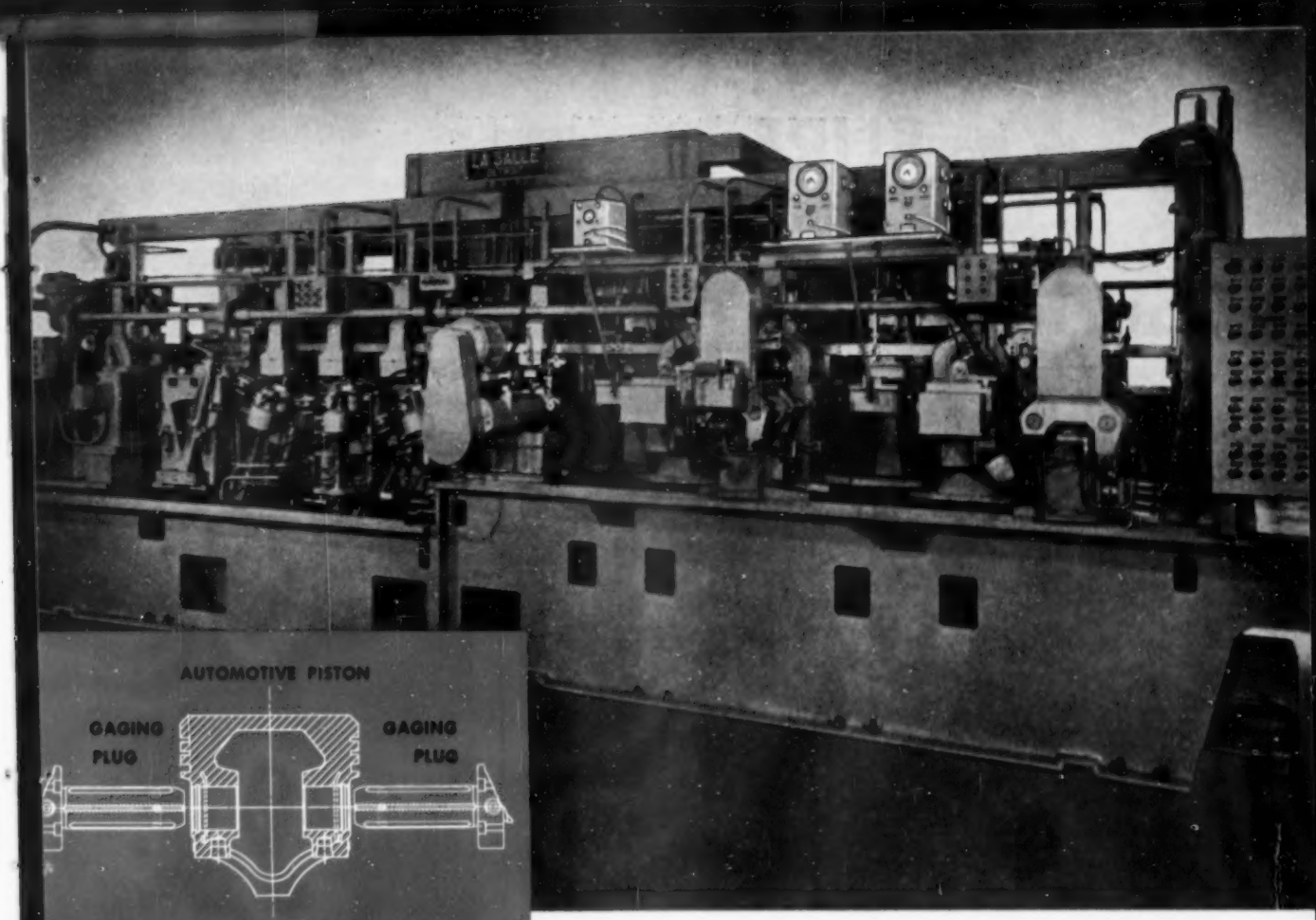
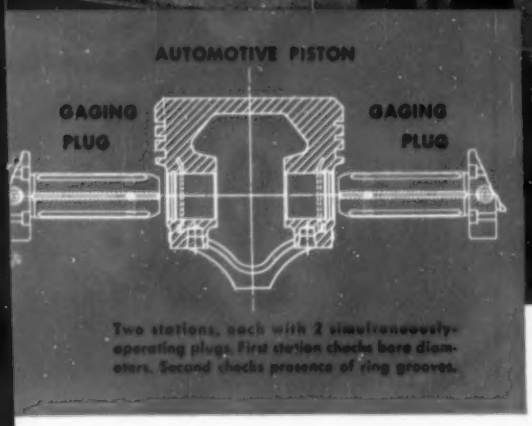
with these packaged, on-the-shelf P&W Air-O-Limit Light Signal Units. Can be used to signal operator or to provide feed-back impulse for fully automatic process control.

BASIC 2-LIMIT UNIT . . . indicates high and low tolerances. Suitable for sorting and other "yes-or-no" control applications.

3-LIMIT UNIT . . . especially suited for grinding and similar operations. Indicates or automatically controls such conditions as: "Fast Feed," "Slow Feed," and "Spark-Out."

4-LIMIT UNIT . . . similar to 3-Limit Unit, but provides greater control scope. Indicates or controls such conditions as: "Approach High Limit," "High Limit," "Approach Low Limit" and "Low Limit."





Two stations, each with 2 simultaneously-operating plugs. First station checks bore diameters. Second checks presence of ring grooves.

PHOTO COURTESY OF LASALLE TOOL, INC., DETROIT, MICHIGAN

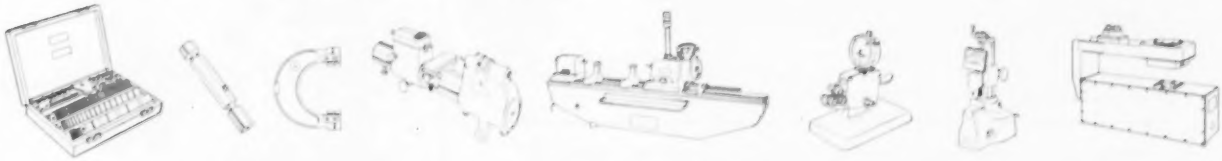
Help Yourself to Increased Output

WITH PRATT & WHITNEY STANDARD, ON-THE-SHELF GAGE CONTROL UNITS

INCREASED OUTPUT RATES, INSURED ACCURACY, REDUCED REJECT LOSSES . . . are the benefits you get with On-Machine Automatic or Automation Gaging! And now, these standard P&W Packaged Units . . . with appropriate tooling . . . can provide an installation tailored to your needs *without* the expense or delays required to engineer and construct special controls.

For example, these P&W Packaged Units made it easy to provide automatic on-machine gaging for this special, high-speed automotive piston machine produced by LaSalle Tool, Inc. Two P&W Air-O-Limit Carbide Gage Plugs are arranged to check the ID of both wrist pin bores on the pistons automatically. Lights on the P&W Control Units signal the operator if tolerances are exceeded. A second set of gage plugs similarly checks bores for the presence of snap ring grooves. If desired, control units can be arranged to shut down the machine automatically when an imperfect part is detected. Whatever *your* requirements, P&W can supply gaging equipment exactly right for the job.

For complete information, write to Pratt & Whitney Company, Inc., 16 Charter Oak Boulevard, West Hartford, Connecticut.



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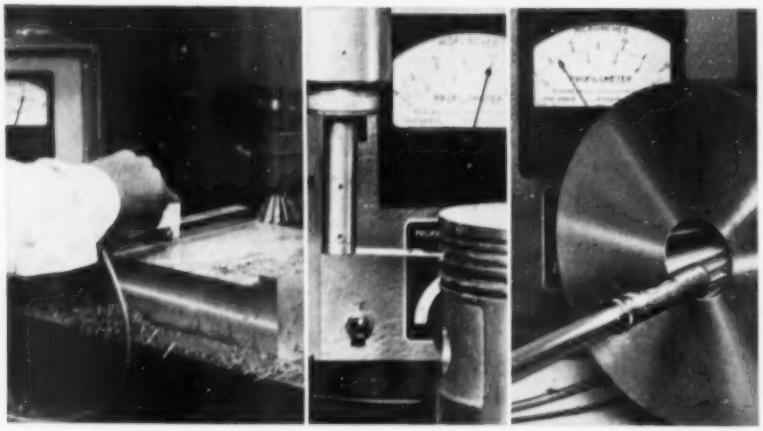

NO NEED TO GUESS or wonder about the roughness of parts that you make or buy. With the PROFILOMETER® at hand, you KNOW the roughness, because —

1 The Profilometer *measures* surface roughness in definite *microinch units* (arithmetical or r.m.s. average height). It eliminates the errors and uncertainties of inspection by touch or sight.

2 It is *accurate* and *dependable*—even below 3 microinches. Cannot be set to give wrong readings.

3 It's a sturdy, portable SHOP TOOL — as easy to use as a dial gage.

4 It is *versatile.* Measures almost *any* surface, internal or external, over any desired length. Measures plastics, glass, etc. as readily as metal.

5 It's been *thoroughly proven* in thousands of production and inspection departments — *since 1936.*

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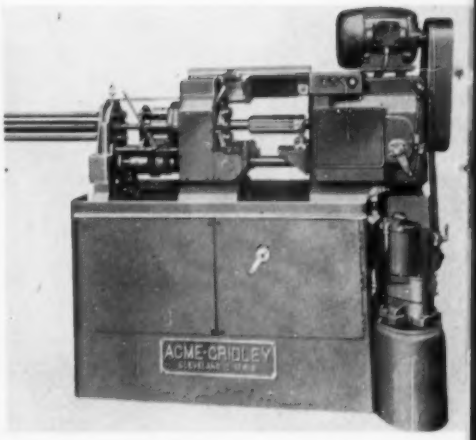


keyway and parallel T-slots for holding down the hinge type toolholders at each spindle station.

The flat lower cross slides are approximately 4 in. wide by 6 in. long. Cams for all slides are easily accessible and can be changed quickly when necessary. Complete cycle of the machine is 0.7 sec. at high speed, including an idle time of 0.466 sec.

The National Acme Co., 170 E. 131st St., Cleveland 8, Ohio. **T-2-1861**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Air Drill

An industrial air drill, the S-P 1000, has ¼-in. capacity, a safety chuck shield and has ¼ hp at 90-lb pressure. A patented metering trigger gives posi-

tive rpm control from 0- to 2500.

The tool, which weighs 2 lb, is available with pistol grip or straight handle.

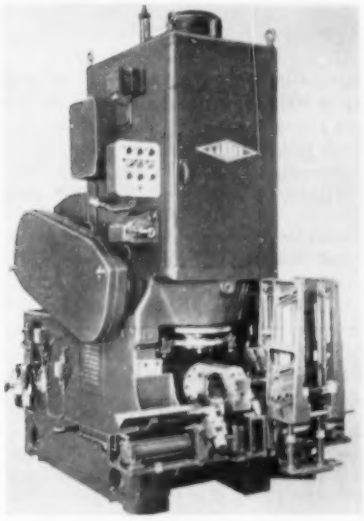
Superior Pneumatic & Mfg., Inc., 4758 Warner Rd., Cleveland 25, Ohio. **T-2-1862**

Tapping Machine

This tapping machine, model 48T, is designed for high production, precision internal threading of couplings ranging in size from 1¼ in. external upset tubing to 6 in. OD casing. Pneumatically operated and electrically controlled, it features automatic operation with maga-

zine feed. It also has adjustable spindle float, receding chaser tap mechanism to assure threads of a positive and precision taper with infinite settings from ¾ in. to 0 taper per foot, detachable tap heads for wide range coverage with minimum tooling cost, set-up ease, lead screw feed, precision worm and worm wheel drive, integral spindle and tap unit for increased strength, and compact construction.

Production rates, at 100 percent efficiency, range from 96 per hour on 1½



in. line pipe couplings to 17 per hour for 5½ in. casing couplings. Standard merchant, conduit and many special couplings can also be tapped on a high production basis. When straight threads are required, the machine can be set up for straight-through tapping and single indexing.

Landis Machine Co., Waynesboro, Pa.

T-2-1871

Portable Nibbler

Pneumatic portable nibbler cuts up to 55 ipm through 10 ga stainless steel without distortion on either side of the cut, leaving the edge ready for fabricating. Short turning radius allows intricate patterns and special openings to be cut in sheet metal without special devices.

The unit weighs 13 lbs and measures 13 in. in length.

Power is furnished by a 5 hp 2-stage compressor which operates a heavy-duty Cleco air motor. Capacity is 10 ga stainless, nickled, CR steel and galvanized iron, 8 ga mild steel, aluminum, brass or other softer metals in proportion. Minimum cutting radius is 6 in.

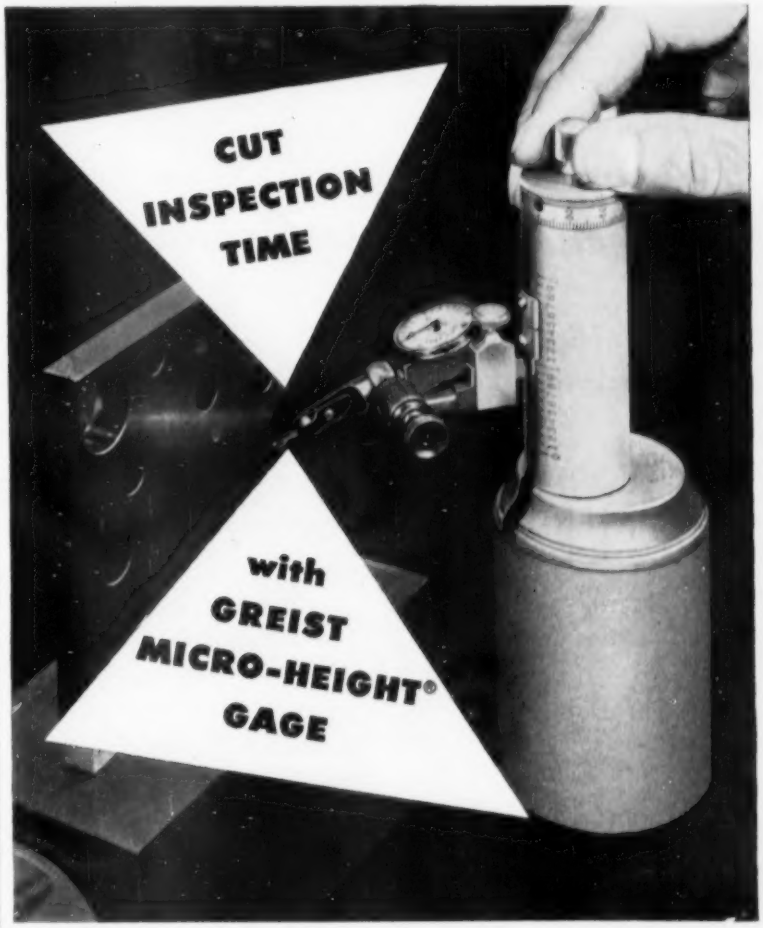
Fenway Machine Co., Edgemont and Clementine Sts., Philadelphia 34, Pa. Distributed by Easco Products.

T-2-1872

Reversing Clutch

Torque converter transmission of the Funk Revers-O-Matic drive requires no clutch or gear shifting. A single throttle lever immediately changes both direction and speed of travel. Two foot pedals may be substituated for the lever. The drive provides smooth, fast acceleration and strong pulling power. The converter multiplies engine torque 200 percent.

The drive is adaptable to any type of operation involving change in direction of movement, either forward and re-



Precision-built Micro-Height reads **faster than your micrometer!** It measures height direct from **zero at base** to 3". Hundredths on barrel ...thousandths on large head that **cuts reading time!** Attach your dial indicator for quick measuring between holes, surfaces!

CUT LAYOUT TIME! Micro-Height also scribes like your vernier height gage. Riser extends range to 9". Precision-built, satin-chrome finished Micro-Height Gage quickly pays for itself!

Call your distributor or write

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Precision Products since 1871

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verse, or lift and lower, on equipment with engines up to 250 cu in. displacement.

Funk Aircraft Co., Box 577-DA, Coffeyville, Kans. **T-2-1881**

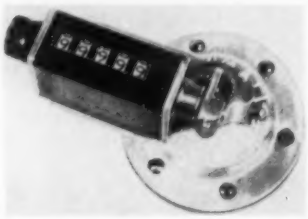
Hydraulic Marking Unit

The #710 hydraulic marking machine, which requires only 18 by 20 in. space, performs normal marking operations requiring up to 8000 lb pressure, with a maximum lettering length of 3½ in. It will stamp up to 4 lines of ⅛-in. characters. This compact unit is built with a heavy die slide which operates on roller bearings. The marker is designed with simplified controls and means for quick and simple adjustment of table and die slide stroke. It will accept flats up to 5 in. thick and rounds to 5 in. in diam. A handwheel adjustment will move the table 4 in. up or down. A single convenient control knob quickly adjusts pressure. Production capacity is 800 to 1000 parts per hour.

The Parker-Hartford Corp., 650 Franklin Ave., Hartford, Conn. **T-2-1882**

Automatic Counter

Designed for use for any operation controlled by pneumatic or hydraulic action, this counting device is screwed into any air or hydraulic line. Models



are available for from 1 to 5000 psi and up to 300 counts per minute. All models are available with five or six digits and knob or key reset.

Pneumaticount, 3400 N. E. 54th Ave., Portland, Ore. **T-2-1883**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Four-Way Air Valve

Designed for up to 250-psi service, this 1½-in., four-way air valve incorporates a pressure-balanced, self-aligning tubular sealing ring in constant

contact with an optically flat porting disk or rotor containing the flow passage. Valve sealing ring, shaft and detent ball are stainless steel; valve body and housing are aluminum.

Barksdale Valve, 5125 Alcoa Ave., Los Angeles 58, Calif. **T-2-1884**

Disk Grinder

Double horizontal disk grinder, No. 240-30, is intended for high-speed precision finishing of piston rings, bearing rings, automatic transmission plates and similar shapes. All spindle motors are contained in the machine base. Other features are: pushbutton controls, quick reading of head and disk alignment, automatic dressing and sizing, magnetic rotary through feed and

For...

General-Purpose Sawing

with

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Accuracy, Economy

Model 4B/M2/E2 Equipped with standard work track (Optional Equipment).

MARVEL No. 4B

HIGH SPEED HACK SAW

Exclusive features

1. Horizontal Ball Bearing Saw Frame.
2. Screw Feed—Automatic or Hand Driven.
3. Quick Return Stroke—allows greater number of strokes per minute.
4. Simple Positive Coolant System.
5. Adjustable Stroke—can be shortened for larger capacity.
6. Speed Range—available in 1, 2 or 4 speed models for wider range of work.

Let us prove to you the many reasons why this MARVEL Hack Saw offers the cheapest, most accurate and fastest "cut-off" method available to you at a low initial cost.

Ask your dealer, or write us for Bulletin GP35 which fully describes and illustrates the many exclusive features which makes this Hack Saw Machine your "best buy".

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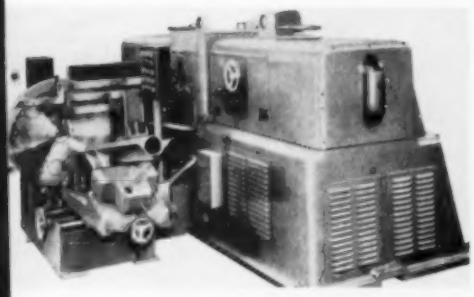


easy disk removal. Accuracies up to 0.0001 in. for parallelism can be obtained.

Besly-Welles Corp., South Beloit, Ill. **T-2-1891**

Skid and Storage Rack

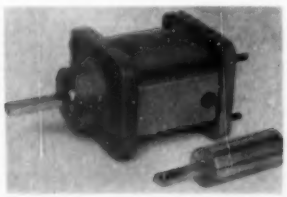
A combined skid and storage rack designed to reduce the amount of individual coil handling by boom and fork lift truck will accommodate as many as 50 heavy gage wire coils at one time. The one piece unit consists of a corrugated steel skid welded to a U-shaped, open-side superstructure. The skid measures 36 in. wide, 72 in. long, with an 18 in. under-clearance. The superstructure, made of $\frac{5}{8}$-in. bar stock, is the same length and width as the skid, but is 54 in. high. Open sides of the skid storage rack permit easy access for loading and unloading.

The unit can be equipped with knee braces or channel runners.

Pressed Steel Div., Republic Steel Corp., 6100 Truscon Ave., Cleveland 27, Ohio. **T-2-1892**

Solenoid

This solenoid, Model K, uses a solid cylindrical slotted plunger which avoids rivet failure. The unit is designed to withstand excessive impact shock, delivers 20 lb. thrust at 100 percent voltage.



It is available for intermittent duty, both in push and pull types.

Heavy duty, porous bronze bearings assure alignment of both the plunger and the plunger extension. Both plunger and extension are polished to eliminate wear and assure long life. In the pull type, an extra long ($1\frac{1}{2}$ in.) bearing is used to guide the plunger, where-

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as in the push type, two bearings are used, one for the plunger and the other guiding the plunger extension.

Square wire is used in the coil to promote heat dissipation and provide mechanical strength. Glass insulation is used for high-temperature operation.

The unit is designed for operation on 115 or 220, 60 cycle, single phase, AC and has a 1¾ in. stroke. Minimum pull, at 100 percent voltage, is 20 lb; minimum pull, at 85 percent voltage, is 12 lb. Current, with plunger extended, is 45 amp; with plunger sealed, is 8 amp.

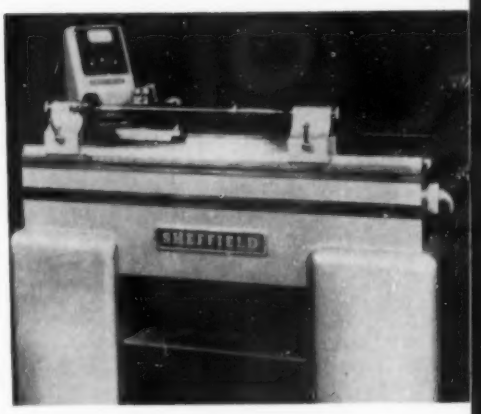
Black & Webster, Inc., Newton, Mass.

T-2-1901

Lead Measuring Unit

This electronic lead measuring instrument, used for detecting lead error in straight and tapered work and rack teeth, is available with accurate drift-free dual electronic amplification of either 1000/2000 or 2500/5000 to 1. Amplification within each dual range can be switched from one to the other without realignment of the indicating meter mechanism. Where amplification is 5000 to 1, direct readings on the zero center equilinear scale can be made to 0.00001 in.

The instrument, called the electronic



Leadchek, will handle work up to 36 in. long and 10 in. in diam with standard tailstocks. Used with Vee-block accessory any length work with diam from ½ to 6 in. can be checked.

The instrument, approximately 59 in. in length, 24 in. wide, and 51 in. high, has an Electrojet transducer type gage cartridge connected to a remote Accutron amplifier. Indicator response is fast and readings are consistently repetitive. The amplifier is unaffected by line voltage fluctuation from 65 to 150 volts.

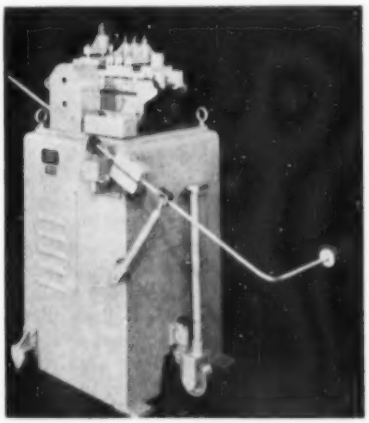
The Sheffield Corp., Dayton 1, Ohio.

T-2-1902

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Power Straightener

Model PDS-4½ power-driven straightener is intended for material up to 4½ in. wide and ⅛ in. thick. It is equipped with a pair of power-driven take-in rolls and six straightening rolls. The upper three straightening rolls are individually adjustable and the lower rolls are power-driven. A hinged construction is used for the straightener assembly so that it can be opened for

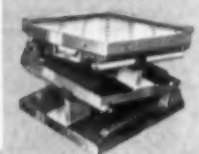


1ST

Your First Choice
FOR ANGULAR TOOLING . . . . ROBBINS!

"Magna-Sine" Magnetic Sine Plates for precision set-ups grinding single or compound angles.

Heavy Duty Sine Plates for angular machining. Wide variety of sizes. 12" square model shown.



Inspection Sine Plates for precision inspection and light machining on single or compound angles.

A look at the record shows exactly why Robbins equipment for angular tooling should be your first choice! Here's the record:

1ST to originate the idea of a simple sine plate for faster angular toolroom set-ups—*1936*

1ST to build these as a standard product for general distribution—*1936*

1ST to build a non-magnetic sine plate designed specifically for precision inspection—*1946*

1ST with a permanent magnet chuck—*1948*

1ST heavy duty sine plate for angular machining—*1954*

1ST *and the only one with* the exclusive "PERMA-FLAT" SWIVEL BLOCK—*1956*

Robbins is the only sine plate manufacturer with a complete line of sine plates for every angular set-up problem in precision machining, grinding and inspection. We also offer complete engineering and manufacturing facilities for the solution of special problems, and are now building high-production automatic assembly and other special machines. Send for sine plate literature, or send us details of your requirements in special machinery.

OMER E. *Robbins* COMPANY
24800 PLYMOUTH ROAD DEPT. E DETROIT 39, MICH.

Also manufacturers of special machinery, automatic assembly machinery.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-190

threading the end of a new coil.

The unit is furnished with forward, stop and reverse controls, indicators on straightening rolls, casters, precision limit switch loop-control arrangement and ½-hp. variable-speed drive motor.

U. S. Tool Co., Inc., Ampere (East Orange), N. J. **T-2-1911**

Slotting Cutter

Available in 102 sizes, a series of flat-faced-blade, staggered-tooth slotting cutters is designed for use on aluminum, aluminum alloys and other light metals. Cutter widths range from 3/8 in. to 2 in., with diameters from 4 to 16 in.

Two keyways are provided on all cutter bodies; one to stagger teeth when

interlocking cutters, the other to line up teeth when straddle milling thin parts. All chip spaces are polished for free-flowing chip disposal.

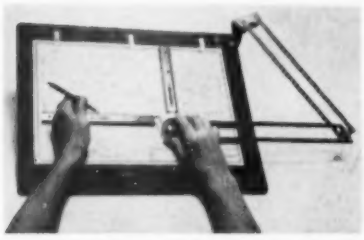
Axial blade serrations allow the blade to be adjusted for width of cut. Blades are anchored to the cutter body by wedges.

Goddard & Goddard Co., 12280 Burt Road, Detroit 23, Mich. **T-2-1912**

Left Hand Drafting Units

Two sizes of portable drafting machines are available in left handed as well as right handed models. Model BL for left handed draftsmen compliments Model B. They are mounted on 15 x 20 in. tempered Masonite boards and take drawing sheets up to 12 x 24 in.

Stainless steel detachable scales, made in both mechanical and architectural types, are furnished on these ma-



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This 48-page illustrated booklet tells how to cut cleaning costs in aircraft production.

1	**How to clean aluminum before anodizing.** See pages 4 to 8.
2	**How to prepare aluminum for welding.** See pages 10 to 14.
3	**How to prepare aluminum for painting.** See pages 15 to 19.
4	**How to clean aluminum before and after heat treating.** See page 20.
5	**How to strip paint from aluminum.** See pages 22 to 26.
6	**How to clean magnesium.** See pages 27 to 29.
7	**How to install cleaning tanks and spray-washing machines.** See pages 31 to 35.
8	**How to control overspray in paint booths.** See pages 36 to 37.
9	**How to clean engine test cells.** See page 40.

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Send me a FREE copy of "*How to clean metals in aircraft production*". I am especially interested in the jobs indicated by the numbers I have circled below:

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COMPANY_____

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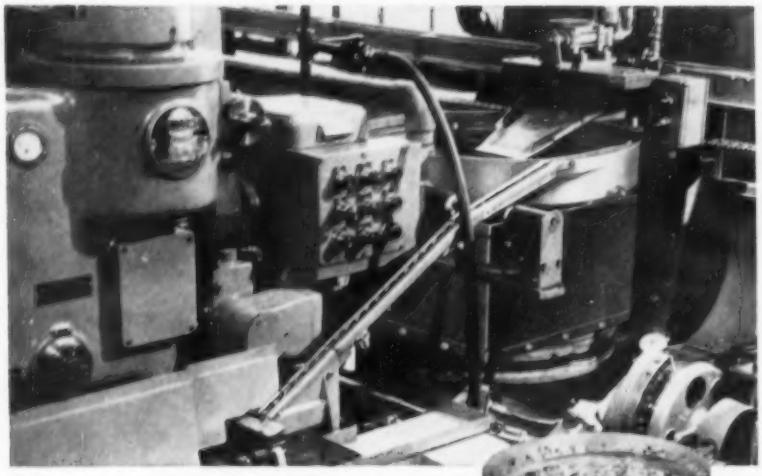

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"Vertical-Vibratory"

PARTS FEEDERS

Provide continuous, high-count, oriented feeding of small parts to automatic machinery

SYNTRON Vibrating Parts Feeders, with their unique, gentle vibrating action and rheostat-controlled rate of feed, have broadened the once limited field of feeding small parts. They increase production by orienting and feeding blanks, semi-finished or finished parts at a high rate to processing and assembly machines.

SYNTRON Vibrating Parts Feeders are adaptable to automatic machinery by means of gravity feed tracks with controlled escapements that deposit the oriented parts as required. They are designed for long, dependable service with little maintenance.

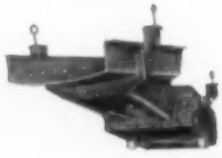
Send samples and data——our application engineers will be glad to submit recommendations.

Other SYNTRON Equipment of proven dependable quality

ELECTRIC HAMMER DRILLS

ELECTRIC VIBRATORS

VIBRATORY FEEDERS



Write for free catalog literature

SYNTRON COMPANY

340 Lexington Ave. Homer City, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-192

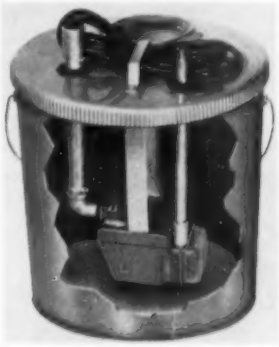
chines. These scales are built to withstand severe abuse without damage. Scale lengths for B and BL machines are 6 and 9 in., BC and BCL models have 9 and 12 in. long scales.

Drafting Equipment Co., 504 Randolph St., Meadville, Pa. **T-2-1921**

Portable Coolant Unit

This coolant unit has a sealed recirculating pump that can be submerged in coolant, free from exposure. Either water soluble or oil base coolants may be used.

Special filter trap protects the pump from chips and cuttings. The pump



does not require any lubrication and has a baked-on plastic coating to resist corrosion.

Three models are available: Model No. 2, 200 maximum gph; Model No. 3,400 maximum gph; and Model No. 4, 475 maximum gph.

Little Giant Pump Co., Div. of Little Giant Vaporizer Co., Inc., 1501 Classen Blvd., Oklahoma City, Okla. **T-2-1922**

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Orbital Sander

Model 800, high speed, lightweight orbital sander is designed for fast material removal. Functioning at 40 psi air pressure, its air consumption is 5 to 7 cfm.

It weighs 3 lb and fits easily into the

palm of the hand. It is intended for sanding edges and moldings.

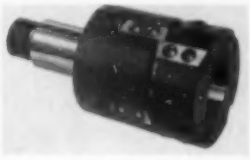
The tool can be used for wet sanding if a separate supply of water is provided. Model 800 takes a 3 by 8 in. sheet of sandpaper.

Pneumatic Div., Sundstrand Machine Tool Co., Rockford, Ill. **T-2-1931**

Tap Holder

Multiple-spindle releasing type tap holder, for screw machine use, operates on a simplified principle that requires few moving parts, minimizing wear and maintenance.

It can be changed quickly and simply for either right-hand or left-hand tapping. It automatically disengages at a predetermined tap depth to hold consistent tolerances on tapping operations. Positive reversing mechanism avoids binding to reduce tap breakage. A floating bushing compensates for misalignment of the tap and the work.

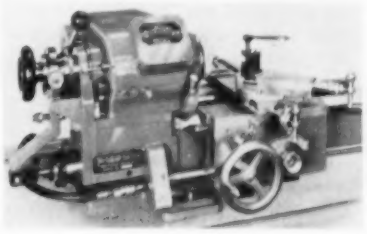


The model illustrated has a 1¼-in. hole and shank, and includes a 1½-in. bushing. The same model is also available in a 2⅝-in. shank. Other sizes are available in standard or special shanks.

Marcellus Mfg. Co., Belvidere, Ill. **T-2-1932**

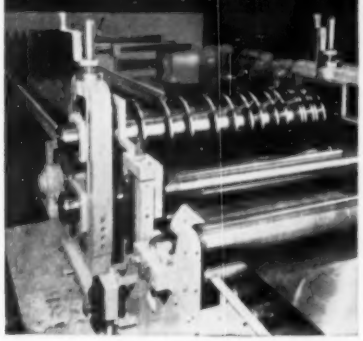
Air-Operated Lever Closer

This lever closer for Wade Tool Co. machines provides easy control of piston speed in either direction. An air cylinder plunger provides the force to actuate the lever closer. The electric valves which operate the plunger are remotely controlled by either push buttons or foot switches.



Operating pressure is controlled by a pressure gage. Filtered air supply passes through a lubrication device. Proper collet tension is obtained through the use of an infinitely adjust-

YODER SLITTING LINES



PAY BIG DIVIDENDS WORKING ONLY ONE DAY PER WEEK!

In one plant, two Yoder tube mills and about 50 punch presses are being supplied with slit strands by one Yoder Slitting Line operated an average of only *seven hours per week.*

In another plant, a Yoder slitting line, *operated from six to eight hours per week,* is supplying two intermittently operated roll forming machines with total requirements averaging 100,000 feet per week.

These typical examples demonstrate, first, the big potential output of a relatively small, inexpensive Yoder standardized Slitting Line and, secondly, its big profitability. Assume production of only 35 tons of slit strands per 8 hour shift, one day per week, and the total per year would be 1750 tons. Estimating the saving in slitting cost at only one-half cent per lb., the total annual saving would be $17,500.00.

Besides the big convenience of doing your own slitting, such savings will often repay the investment in a few months.

The Yoder Slitter Book is a comprehensive treatise on slitter operation and economics, with time studies, cost analyses and other useful data. It is yours for the asking.

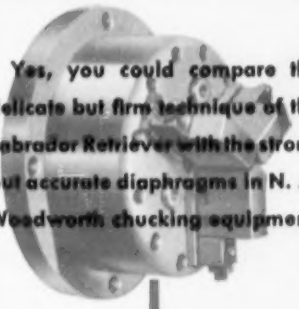
THE YODER COMPANY
5525 Walworth Avenue • Cleveland 2, Ohio, U.S.A.

ENGINEERING YODER MANUFACTURING SLITTING LINES

INDICATE A-2-193-1

HOLD IT!

WITH WOODWORTH CHUCKING EQUIPMENT



Yes, you could compare the delicate but firm technique of the Labrador Retriever with the strong but accurate diaphragms in N. A. Woodworth chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of Woodworth chucking equipment.

• Standard Diaphragm Chuck • Air-Operated Diaphragm Chuck • Bevel Gear Chuck • Double Diameter Gear Chuck • Finger Chuck • Air-Operated Diaphragm Arbor • Push-Lock Arbor • Twist-Lok Spline Arbor • York-Lok Collet Arbor • Zero Spindle Inspection Fixture

"Accuracy you can trust"

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INDICATE A-2-193-2

Zagar

Gearless Drill Heads

put 4 big advantages to work for you

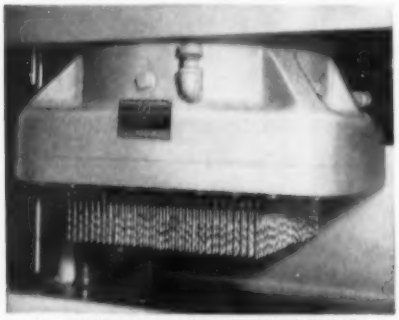
Any number of holes

Any hole pattern

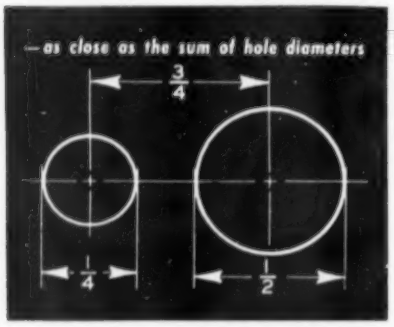
Any material

On all centers

Any hole pattern — on any center up to 1½" dia.



Up to 1200 holes can be drilled IN ONE PASS.



A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.

Can you visualize the savings made possibe by drilling up to 1200 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer — one *best* answer — for those requirements. May we supply it?

Get more information via Zagar's Engineering Data Sheets.

ZAGAR INCORPORATED
23892 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-2-194

able clamp, which also provides a positive release.

The Wade Tool Co., 49 River Street, Waltham 54, Mass. **T-2-1941**

Boring Bar

Tool steel boring bars are available with four flats and straight or angular square holes. Standard sizes from ½ to 1½ in. in diameter are available for immediate delivery.

Forged bits, made of solid high-speed

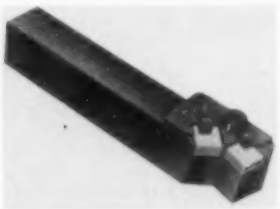
steel, are also offered on an off-the-shelf delivery basis for standard sizes from ⅜ to 1 in. diameter shanks with boring capacity from ¼ in.

Maxwell Industries, Inc., Macedonia, Ohio. **T-2-1942**

Insert Tool

Sixteen indexable cutting edges per button insert are available in this two-in-one Kendex tool for facing and chamfering in a single operation.

Kendex "turnover" carbide button inserts only ½ in. square provide eco-



nomical and efficient cutting operations. Only the middle of the chamfering insert is used, thus permitting exchange of the two inserts when each has been used in eight positions.

Kennametal Inc., Latrobe, Pa. **T-2-1943**

Electronic Indicator

Portable dimensional gage and comparator will gage accurately to 0.000010 inch. The unit, identified as Model IA-515 Indi-Ac electronic indicator, features three coded meter scales that make it possible to read dimensional variations of from 0.000010 to 0.001 of an inch. Change from coarse to fine measurements is accomplished by turning the range switch; zero points and

readings coincide on all scales without separate adjusting for each scale. A wide-range centering control permits shifting the zero electrically to facilitate setup. The unit consists of an adjustable gage head, amplifier and stand.

Cleveland Instrument Co., Inc., 735-737 Carnegie Ave., Cleveland 15, Ohio.

T-2-1951

USE READER SERVICE CARD ON PAGE 173 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Limit Switch

Enclosed precision limit switch, called the Licon (R) Type 30 switch, is designed with interchangeable components, made up of three actuators and three housings, to form sixteen types of switches. Actuators include a plunger type, illustrated, and roller arm and roller plunger types. Easy installation is accomplished with #10 through bolts

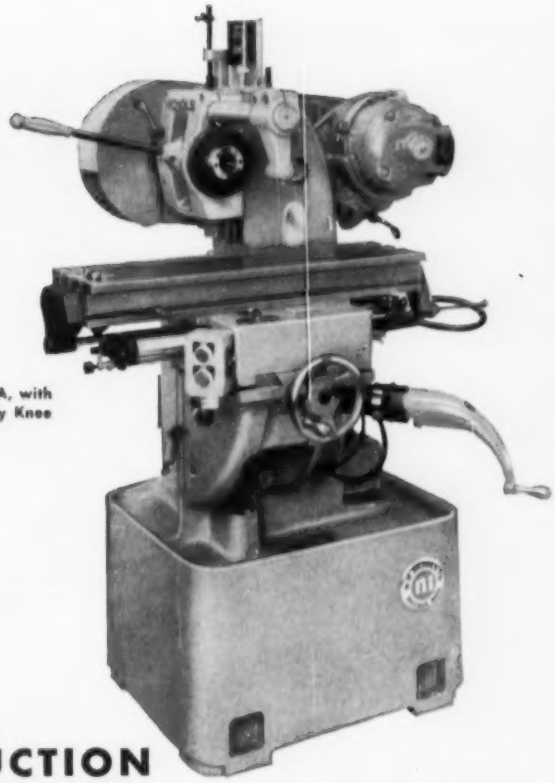
or with an alternate bottom mounting plate supplied with every switch. The units are easy to install and adjust.

Both the roller arm actuator and the roller plunger type are designed to take actuation from any direction. The plunger actuator type switch has a 0.002 movement differential and a ½-in. overtravel.

The Licon (R) Type 30 sealed enclosed limit switch is oil, dust and water tight. Switch actuation is sensitive.

Licon (R) Switch and Control Division, Illinois Tool Works, 2501 N. Keeler Avenue, Chicago 39, Illinois.

T-2-1952



Model 8-SA, with Heavy-Duty Knee

FOR HIGH PRODUCTION TO "TENTHS"

SEMI-AUTOMATIC NICHOLS MILLER

"The Versatile Miller That Uses Its Head"

Nichols Semi-Automatic Millers are equipped with "easy to set up" air-hydraulic table cycles providing rapid approach, variable cutting feed, and rapid return. The operator merely loads and unloads.

In addition to the automatic table feed, the Rise and Fall Spindle head and the Cross Feed may be so equipped. It adds up to a flexible combination of synchronized automatic motions which make Nichols ideal basic millers for modern production lines.

Available in two models—the 8-SA with Heavy Duty Knee and Saddle to support 8½" x 30" table having 14" stroke . . . and the 6-SA with Standard Duty Knee supporting 6¾" x 21" table having 9" stroke.

The Nichols SEMI-AUTOMATIC, and all Nichols Millers, provide unequaled accuracy that saves cutter costs and BOOSTS PRODUCTION.

CONDENSED SPECIFICATIONS

	MODELS 6-SA	8-SA
Table Working Surface	6¾" x 21"	8½" x 30"
Total Table Stroke	9"	14"
Total Cutting Stroke	5¾"	14"
Transverse Travel	7"	6"
Vertical Travel—Knee	13½"	11"
Rise and Fall of Spindle	4½"	4½"

Selective Speed Ranges up to 5000 R.P.M.

MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors **THE ROBERT E. MORRIS COMPANY**

5006 FARMINGTON AVENUE • WEST HARTFORD 7, CONN.

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MAGNESIUM *machinability beats tight schedules*

Machinability and handling ease are two reasons Carr Lane moves jobs faster, at lower cost, with magnesium tooling plate

When a job has to be completed in a hurry, which is often the case at Carr Lane Manufacturing Company, St. Louis, there are big advantages in using magnesium tooling plate.

FASTER MACHINING. Production operations go faster because magnesium jigs and fixtures are easy to machine, easy to weld. Excellent dimensional stability and precision flatness help to hold the closest tolerances. These properties also help to save many hours in the process. On the fixture illustrated, it would take twice as long to do the job in aluminum—and ten times as long in steel.

FASTER HANDLING. The light weight of magnesium, two-thirds that of aluminum, permits pieces to be handled and moved from one operation to another with a minimum of time, effort and equipment. This is particularly important with large jigs and fixtures which couldn't be handled manually if they were made of steel.

FASTER AVAILABILITY. You can get magnesium tooling plate when you want it and how you want it. Whether production deadlines are tight or not, it's always readily obtainable in any standard size and gauge from stock. Contact your nearest supplier of Dow Magnesium or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 1442U.

Available from stock at . . .

Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Co., Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON DOW

Men at Work

Jerome A. Raterman (left), president of Monarch Machine Tool Co., is now president of the National Machine Tool Builders Assn.

Ludlow King (right), elected to succeed Tell Berna, who retired after 20 years' of service, now becomes executive vice-president of NMTBA.

Officers elected to serve NMTBA with new president Raterman are Alfred V. Bodine, president and treasurer of The Bodine Corp., as first vice-president; Ralph J. Kraut, president of Giddings & Lewis Machine Tool Co., second vice-president; Kalter K. Bailey, president of Warner & Swasey Co., secretary and director; and Edward R. Smith, president and treasurer of Seneca Falls Machine Co., director. Mr. Kraut and Mr. Bailey are members of ASTE's Fond du Lac and Cleveland chapters respectively.

Paul N. Stanton was promoted to the post of sales manager of The Lapointe Machine Tool Co. according to Joseph P. Crosby, vice-president in charge of sales.

W. Paul Eddy, chief of engineering operations at Pratt & Whitney Aircraft Div., United Aircraft Corp., has been elected president of the Society of Automotive Engineers.

Duncan P. Forbes, immediate past president of Gunite Foundries Corp., has advanced to the office of chairman of the board, succeeding **John A. Forbes** who retired.

Appointment of **Max C. Farmer** to the recently created post of technical director was revealed by The Beryllium Corp. Mr. Farmer has been staff metallurgist on the materials advisory board of the National Academy of Sciences.

George G. Raymond, Jr., president of The Raymond Corp. has been re-elected president of The Material Handling Institute, Inc. for another term. At the same time, **R. L. Fairbank,** vice president of Towmotor Corp., was elected first vice-president of MHI, and **Eugene Caldwell**, vice president and general manager of Hyster Co., was elected second vice-president.

Henry F. Dever, president of Brown Instrument Div. of Minneapolis-Honeywell, has been given corporate responsibility for directing the parent company's activities in the industrial controls field. He will be responsible for over-all planning in that field and will counsel and coordinate engineering and manufacturing operations of seven M-H divisions. He also will continue to head Brown Instruments Div.

New officers elected by the Investment Casting Institute include **K. W. Thompson,** president of the K. W. Thompson Tool Co., as president of the organization; **P. W. Schipper,** manager of the Investment Casting Div. of the Howard Foundry Co., vice-president; and **V. S. Lazzara,** president of Casting Engineers, Inc., treasurer.

E. C. Fales has been named president and general manager of Gunite Foundries Corp. Previously he was executive vice-president of the company and in that capacity headed the Foundries' expansion in automotive and commercial castings fields.

Edward H. Perkins recently became vice-president of Brooks & Perkins, Inc. A director of the company for the past two years, he is manager of the company's Magplate Div. and administrative assistant to the executive vice-president.

Henry M. Haase was elected vice-president in charge of engineering and research for Borg-Warner Corp. where he will direct the program of product planning and engineering research and development. He formerly was assistant to the president.

Sidney L. Eastman is now vice-president in charge of engineering for The Cleveland Worm & Gear Co. Associated with the company in various engineering and sales capacities since 1927, Mr. Eastman formerly was chief engineer of the firm.

Board of directors of A. O. Smith Corp. has elected **U. T. Kuechle** and **Roy A. Dingman** vice presidents of the company. **Robert A. Rietz** was named assistant secretary. Mr. Kuechle has been automotive sales manager, while Mr. Dingman joined the firm last April as director of industrial relations.

According to announcement from Aluminum Co. of America, **James P. Haight** has been named vice-president in charge of engineering and purchasing, succeeding **Thomas D. Jolly** who retired. Mr. Haight, who joined Alcoa in 1920 was named its chief engineer in 1945 and last April was elected a vice-president.

Promotion of **Martin J. Caserio** to the post of director of engineering and equipment sales at AC Spark Plug Div. of General Motors has been announced. He has been chief engineer of automotive products and research since 1953.

B. R. Teree is new chief engineer of Greer Hydraulics, Inc. where he will be responsible for administration of all engineering activities of the division.

James W. Hutchison has been appointed vice-president in charge of reduction at Olin Revere Metals Corp. He has been plant manager of the Jones Mill Reduction Plant at Reynolds Metals Co.

Giddings & Lewis Machine Tool Co. has revealed three changes in its administrative personnel. **Erwin J. Kaiser**, general manager of the Davis Boring Tool Div., has been made staff vice-president-manufacturing of Giddings & Lewis Machine Tool Co. Mr. Kaiser is a member of ASTE's Fond du Lac chapter. **George K. Cassady,** who is sales manager of the G&L and Hypro division, succeeded Mr. Kaiser as general manager of Davis Boring Tool Div. Succeeding Mr. Cassady in his former post is **Guy E. Lingenfelter** who was assistant sales manager of the division.

Joseph Warren Barker is new president of Engineers Joint Council for 1957. Mr. Barker is chairman of the board and president of Research Corp. **Fischer S. Black,** publisher and editor of *Electrical World* magazine, was elected vice-president of the organization.

New director of production engineering on the Chrysler Corp. manufacturing staff is **Russell S. Rockafellow.** A member of the organization since 1952, he has been chief industrial engineer on its manufacturing staff.

Lindberg Engineering Co. has announced appointment of **John R. Duffy** as chief engineer. Besides directing activities of the engineering department, he will be responsible for design of the company's line of heat treating furnaces, kilns and high vacuum heating equipment.

Kenneth W. Donle has been appointed manager of product engineering for Tube Reducing Corp. In the new post, he will also be responsible for new product development. A member of the organization since 1951, Mr. Donle was manager of Rockdrawn Tubing Div.

Election of three vice-presidents, made public by Illinois Gear & Machine Co., involved **T. S. Pacer, E. B. Smiley** and **G. P. Sullivan.** Each of the men has served with the company for more than 20 years occupying key positions.

Robert E. Buckholdt is new manager of engineering for Selas Corp. of America. Prior to this appointment, he was vice-president of Kendall Contracting Inc. where he engaged in engineering, layout and construction of forging plants.

A. R. Reinarz has been promoted to chief engineer and **Richard N. Cordrey** to assistant chief engineer at the Toledo plant of The National Supply Co. Mr. Reinarz, who succeeds **H. L. Wilke,** recently named assistant director-engineering, has been administrative engineer. Mr. Cordrey was chief designer.

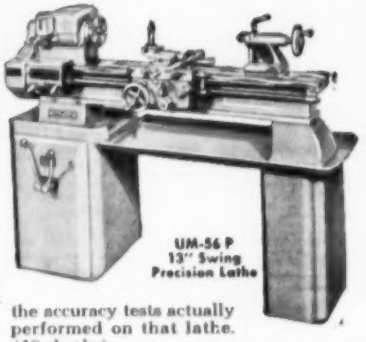
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

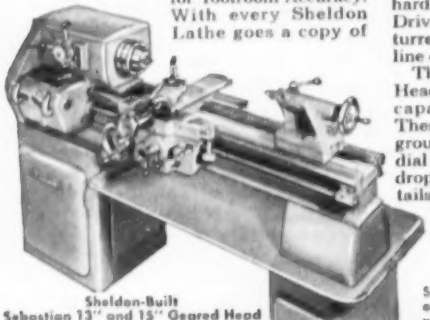
All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-56 P
13" Swing
Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



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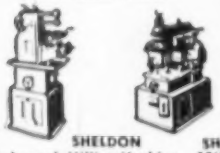
Sebastian 13" and 15" Geared Head
Precision Lathes



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Horizontal Milling Machine

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☐ Sheldon ☐ 10", ☐ 11" ☐ 13" Lathes
☐ Sebastian 13" and 15" Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call

Name ..... Title .....

Company Name .....

Street Address ..... ☐ Company ☐ Home

City ..... State .....

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-198

technical Shorts

INTRICATE SHAPES such as full size cermet turbine blades may be cast as a consequence of a technique resulting from research at Lewis Flight Propulsion Laboratory in Cleveland. The method, reported by Armour Research Foundation's Industrial Research Newsletter, consists of preparing an extremely thick slip of such a material as titanium carbide with a small amount of binder, casting the slip into a mold, and freezing to retain the mold's shape. The casting then is dried by sublimation, and is sintered or semisintered and infiltrated.

New Process Implements Intricate Casting

Current techniques for forming refractory carbides, oxides, silicides, borides and cermets are more expensive because they involve grinding either fully sintered or semisintered blanks to shape.

★ ★ ★

WITH THE DISCOVERY by National Carbon Co. Laboratories that high pressure can prevent vaporization when graphite is heated to high temperature, came the first "welding" of graphite. The resultant welded graphite will allow scientists to prefabricate sheets and panels for assembly of nuclear reactor moderators that now must be made from graphite blocks. The new technique already has led to production of new forms of graphite which are considered crystally more nearly perfect.

Develop Technique to Weld Graphite

★ ★ ★

ALUMINUM PRODUCTS produced by impact extrusion may be obtained with a thin surface cladding according to an announcement by Aluminum Co. of America. As a result inexpensive aluminum impact extrusions are likely to enjoy a considerably broadened usage. This thin cladding provides cathodic corrosion protection, facilitates finishing, or makes joining easier.

Corrosion Protection By Cladding

The technique utilizes Alcoa's Alclad process in which a thin layer of aluminum alloy is bonded to sheet or plate. This method of cladding has been found to provide extruded parts with a protection even when slight surface imperfections exist.

It also is possible to clad high strength parts with an alternate aluminum alloy suitable for all types of finishing processes. A thin layer of brazing alloy may be applied on either the inside or outside of the impact extrusion, providing new possibilities in the assembly and joining of such items as appliance parts, electronic components or aircraft assemblies.

Until now, aluminum alloy impact extrusions have been difficult to clad due to a combination of mechanical factors. A series of technical advances, including rearrangement of the aluminum slugs, changes in die tool design, and variations in extrusion pressures were utilized to solve the problem.

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Thicknesses .006 to ½"
Spacers are supplied as needed.
Every Circle R slitter is a "special" — made right, to do a specific job best in slitting textile metallics, sheet steel, rubber, brass, sand paper, etc. For efficiency in slitting any substance, consult your Circle R representative!
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TOUGH LITTLE DRILLS THAT PACK A BIG WALLOP ON AUTOMOBILE ASSEMBLY LINES

New York's body drills are specially designed for accelerated assembly lines. You'll find them in the country's largest auto plants because they bite fast, make clean quick holes and are extra tough for long and continuous service.

These heavy duty drills feature extra sturdy shanks, short flutes – with or without radial relief – and split points that help minimize operator fatigue. Then there's New York's special nit-riding and homo-treating to add to their toughness. As with our standard drills, New York's body drills give you a saving of 20%.

All New York drills are made to last longer and give greater production. Holes are perfectly round, exactly on size without burrs, and you get more holes per drill. Perfect reasons for using New York drills on *your* assembly line – or wherever there's a difficult operation.

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INDICATE A-2-200-1

MACHINE TOOL LEASING—*by J. L. Treynor and Richard E. Vancil. Published by Management Analysis Center, Inc., 275 Newbury St., Boston, Mass. Price $15. 147 pages.*

Since January 1954, the leasing of machine tools has become a subject of increasing interest to those employed in the metalworking field. Within this period practically all the major machine tool manufacturers have announced the availability of one or more leasing plans. This sudden availability of leasing plans raises many questions which must be answered before an intelligent decision can be made as to buying or leasing equipment. This report is for practical use by practical businessmen; the theoretical approach has been discarded in favor of a dollars-and-cents focus.

Essentially, this report is predicted on the assumption that relative cost is the most significant aspect of a buy-versus-lease problem.

A set of cost tables for every known machine tool leasing plan was worked out and they may be referred to each time a decision to acquire a machine tool is required.

In all, the book presents a factual picture of the buy or lease problem as it exists today and it can be used as a guiding hand by both large and small manufacturers.

MACHINE DESIGN—*By Joseph Edward Shigley, Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, New York. Price $7.75. 523 pages.*

For many years machine design has occupied a prominent position in the engineering curriculum of most colleges. A prime reason for this is that students find it necessary to select information from many different areas of study. Also machine design may act

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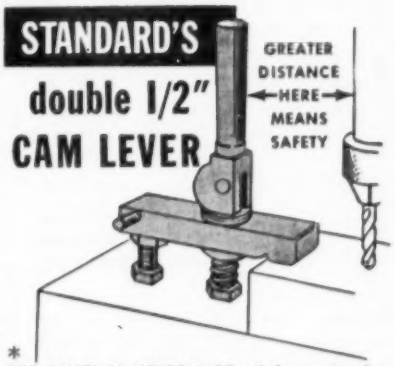
...up to 3,450 lbs. clamping force



*THE JAMES H. HERRON CO., (Laboratories for Testing, Analysis and Inspection) reports as follows: "With reference to the Double Cam Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated. "Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt."

Finger Tip Can Tighten Clamp.

Easy to Use— Positive Action

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- **Safe Operation—with handle *vertical* before clamping (as illustrated).**
- **Constant Maximum Clamping Pressure—perpendicular to center line of lever.**
- **Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.**
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- **This Cam can be applied to your Specially Designed Assemblies. Quotations on request.**

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INDICATE A-2-200-2

as an intermediary between these areas of study which are basically scientific and analytic and the more practical engineering courses. In this book, the author has attempted to develop the relations between design specifications and the method of analysis or synthesis used in the solution.

The book is divided into two parts. Part I constitutes a study of the design of fundamental machine members. Part II applies the principles developed in Part I to the study of various design approaches to a group of common machine elements.

ENGINEERING INSPECTION, MEASUREMENT AND TESTING—*By H. C. Town and R. Colebourne. Published by Philosophical Library, Inc., 15 E. 40th Street, New York, 16, N. Y. Price $7.50. 192 pages.*

The establishment of accurate standards of measurement has presented a recurring problem to human ingenuity down the years. From the earliest day, man has been compelled to make measurements and standardize such fundamental units as time, weight and distance. However, this book concerns the measurement of length, primarily.

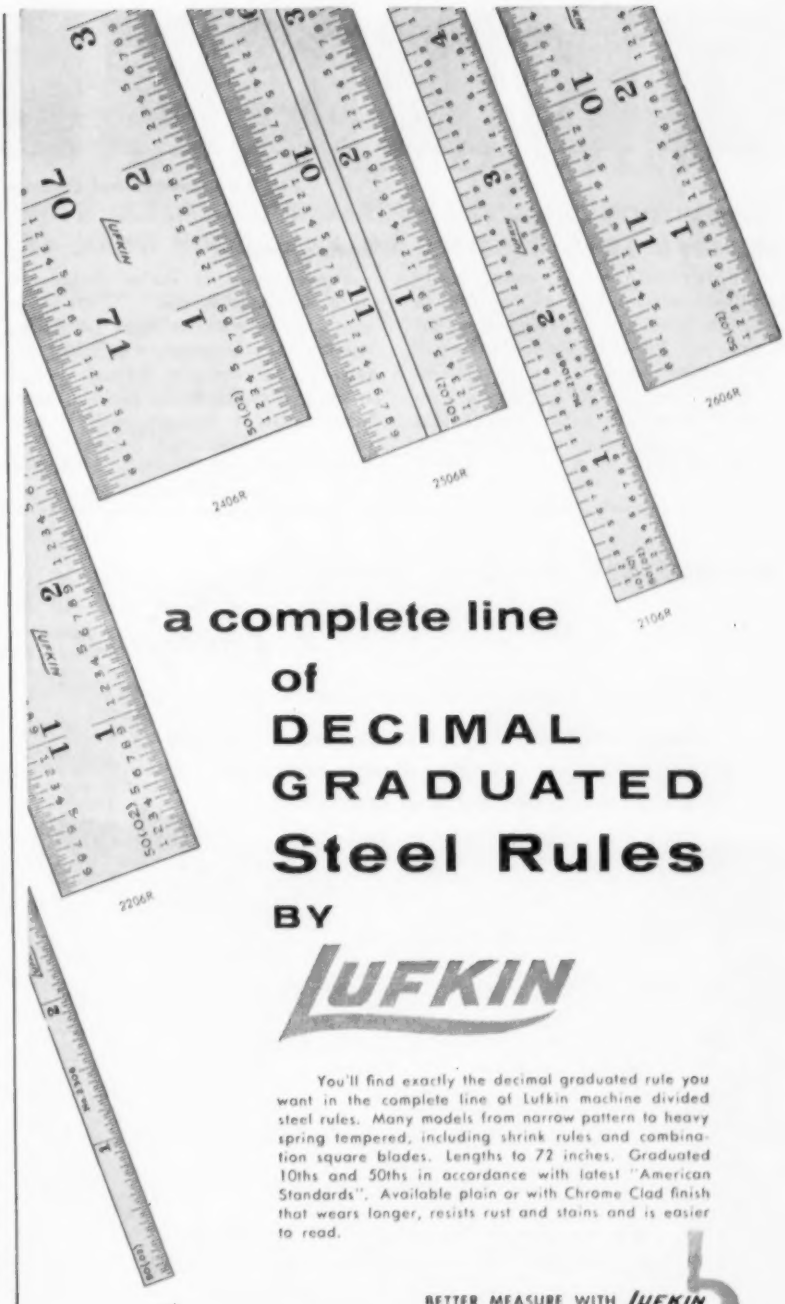
First, the authors explain the function of the modern factory inspection department, and briefly trace the development of recognized standards and methods of measurement. Later chapters deal with the principles and practice of precision measurement. Special attention is given to measurement during machining and automatic sizing operations. The final chapter is devoted to measurement of surface finish.

HOW TO FIND A BUYER FOR YOUR INVENTION—*By V. D. Angerman. Published by Science and Mechanics Publishing Co., 450 E. Ohio St., Chicago 11, Ill. Price $2.95. 186 pages.*

Periodically, tool engineers are confronted with the problem of finding a buyer for an invention, or of finding some to talk to and decide whether an idea is worth obtaining a patent. To ease these situations, the Editor of Science and Mechanics has established a plan of contact between a qualified inventor and an interested manufacturer. This plan is fully explained in this book. Also included is a list of 140 manufacturers, in many fields, who are interested in new products, processes, methods or machines.

Inventors are given simple instructions on how best to contact a busy industrial executive on new products or ideas relating to his field.

The book shows careful research and selection of material that can easily be applied to everyday new product problems.



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TRADE literature

For Free Booklets and Catalogs — Convenient Request Card on Page 173

Silicones

Approximately 150 commercially available silicone products described in 12-page "1957 Reference Guide to Dow Corning Silicones"; products are grouped by usage to permit engineers to locate material by what it does; includes charts, tables and graphs plus application photographs. Dow Corning Corp., Midland, Mich. **L-2-1**

Spring Design

Fundamentals of spring design set forth in 8-page brochure, "Spring Design and Selection—in Brief", in quick, easy-to-follow form yet in sufficient detail to help designer through initial stages of a spring design problem. Contains pertinent formulas, tables, and other data. Associated Spring Corp., Bristol, Conn. **L-2-2**

FINE CUTTING TOOLS by Eclipse

Since 1913 Eclipse has been consistently and conscientiously serving many companies in widely diversified fields of production. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools.

- High Speed Steel Cutters
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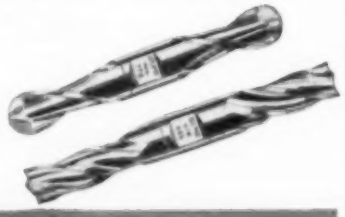
Eclipse now has a complete line of Precision End Mills. Ground from the solid, Eclipse End Mills insure longer tool life, finer finishes and lower production costs.



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Shell Molding

Illustrated 32-page booklet, "Plaskon Resins for Shell Molding," describes the shell molding process for casting metals with emphasis on foundrymen's problems; includes design and production considerations, available types of molding machinery and factors in making selections, gating techniques and precautions, pattern design, resin bonding of shell molds, special metals handling, and sand reclamation. Request directly from Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y.

Casting Design

Form of design, method of making patterns, molding procedure, characteristics and behavior of metal in the mold, and other elements involved in production of dependable engineering castings discussed in simple manner in 64-page manual, "Casting Design as Influenced by Foundry Practice." Well illustrated by drawings. Meehanite Metal Corp., 714 North Ave., New Rochelle, N. Y. **L-2-3**

Surface Grinding

Fourteen difficult and unusual surface grinding applications performed by automotive plants, machine tool builders, makers of tool steel products and other metalworkers graphically described in "Case Histories"; illustrated. Mattison Machine Works, Rockford, Ill. **L-2-4**

Coated Fabrics

Four-page bulletin on Cohrlastic silicone rubber coated fabrics and nylon resin coated nylon fabrics lists stock and standard fabric constructions, discusses properties, applications, base fabrics and coatings. The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn. **L-2-5**

Lubricants

Information on choosing the right lubricant for specific conditions of operation presented in 4-page Bulletin No. 138 "Lubricants for Stamping and Deep Drawing". Includes detailed description of each lubricant's properties, its application to metals and concentrations used. Dept. TE, Magnus Chemical Co., Inc., Garwood, N. J., Lubricants Div. **L-2-6**

Optical Comparator

Eleven page engineering study, "Optical Analysis of Gears and Splines", offers detailed discussion of the subject well illustrated by drawings, diagrams and charts. Comparator Div., Jones & Lamson Machine Co., Springfield, Vt. **L-2-7**

Switches

Heavy duty precision switches for machine tools and other industrial equipment described in illustrated folder outlining uses and advantages. Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill. **L-2-8**

Carbide Tools

Revised 100-page catalog describes and illustrates line of precision solid carbide tools; also includes engineering data and latest information on use and care of solid carbide tools plus reference data and tables pertinent to various tools; includes price lists. The Atrax Co., Newington, Conn. **L-2-9**

Tube Fittings

Assembly instructions, and information on materials, finishes and operating pressures given with complete engineering data and specifications for Weatherhead 7000 series and 8000 series Ermeto hydraulic flareless tube fittings and Weatherhead . Flare-Twin SAE 37° flare (JIC) hydraulic tube fittings. The Weatherhead Co. Customer Service Dept., 128 W. Washington Blvd., Fort Wayne, Ind. **L-2-10**

Saw Blades

Comprehensive 8-page catalog describes line of carbide tipped saw blades engineered for specific cutting requirements and conditions; illustrated with drawings and photographs. Forrest Mfg. Co., Inc., P.O. Box 189 Rutherford, N. J. **L-2-11**

Tube Bending

Folder presents information on operation and advantages of precision tube bending machines made by J. Banning A.G., Germany, for producing accurate bends without necessity of filling; illustrated. Henry A. Spittler, Inc., Monroe, N. Y. **L-2-12**

Instrumentation Bibliography

Bulletin G-2 serves as an index of Industrial Div. literature on industrial instrumentation; covers bulletins, specification sheets, data sheets and illustrated lectures and articles. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa. **L-2-13**

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Preselective automatic positioning anywhere within a 50" x 30" area.

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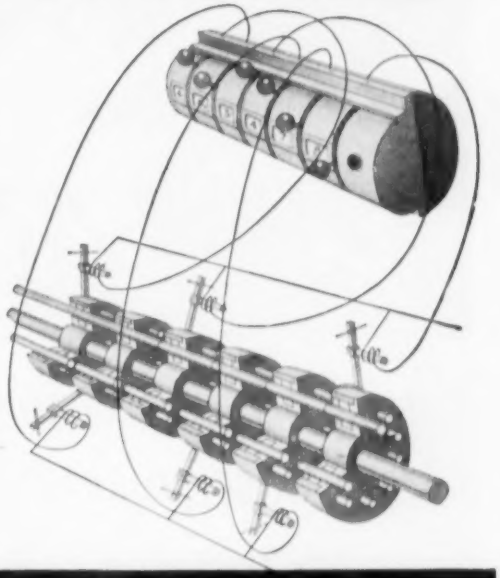

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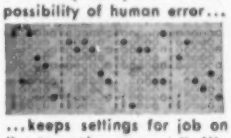
Automatic Punch Card control completely eliminates possibility of human error...



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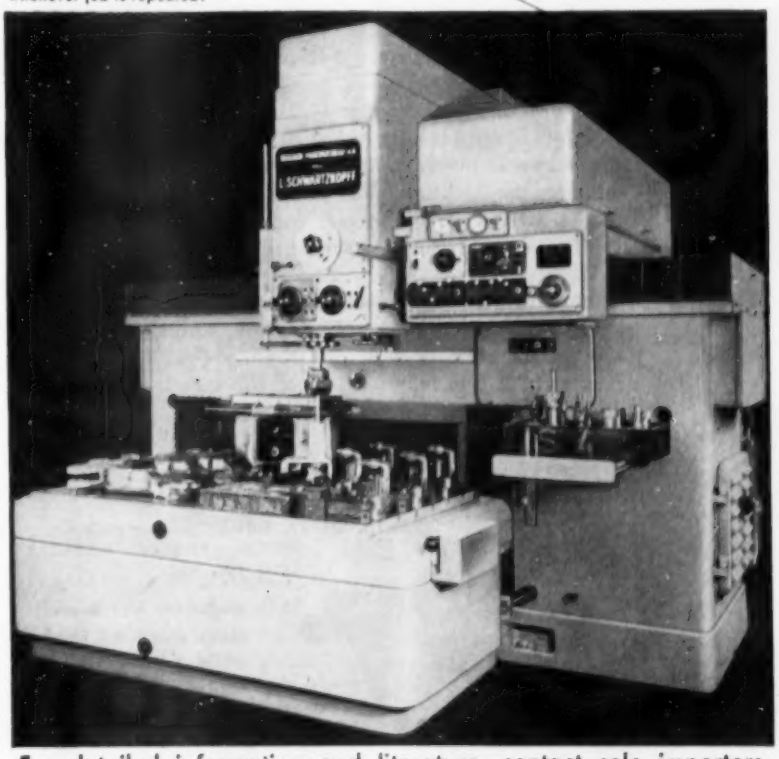

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New I-R Torque Control Impactools prove value on auto assembly line

A leading auto manufacturer reports greatly improved *product quality* on 3 auto and truck assembly line operations where Ingersoll-Rand Torsion Bar Torque Control Impactools have been used for 6 months.

A safety hazard is eliminated on one operation, where these new Impactools have made torque control possible for the first time. The photo above shows the I-R Size 5040T Torque Control Impactool securing the steering gear assembly to the truck frame.

Other major benefits include time saving, because these Impactools operate at full power and speed until they automatically shut off when pre-set torque is reached . . . and elimination of the need for hand torqueing on many nut running jobs.

Size 5040T 2 Torsion bars available with max. torques of 60 and 90 ft. lbs.

Write for the complete story on this latest I-R development!

Ingersoll-Rand

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Heat Treating

Illustrated circular, "Heat Treating in Four Easy Steps", discusses simplified process of heat treating tools and steel parts using the Armor-Tuf steel hardening compound. Armor-Tuf Sales Corp., 299 Madison Ave., New York, N. Y. **L-2-14**

Motors

Full information on how to select a-c motors for specific applications presented in 12-page Reliance Motor Selector, Bulletin B-2103-1; covers speed-frequency relationship, NEMA design classes, torque characteristics, NEMA current and torque values, frame selection tables and dimension charts and mechanical modifications for all frame sizes from 182 to 6085. Reliance Electric and Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio. **L-2-15**

Machine Tools

Twelve-page illustrated catalog features selection of Swiss high precision-machine tools including Tornos automatics, Kummer dual head lathe, Hauser jig borers, jig grinders and pivot burnishers, Schaublin lathes and milling machines and Walter cutter grinders. Carl Hirschmann Co., Inc., Manhasset, N. Y. **L-2-16**

Brushing

Detailed information on how to select and use power brushes contained in 100-page catalog, "Brushes for Industry;" covers power brush uses, types and terminology, typical power brushes, selection chart, engineering data, brushing machine tools and a description of Osborn's brushing analysis service. Each item in catalog is illustrated and described. Richard M. West, The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio. **L-2-17**

Work-Holding Fixtures

Fourteen-page Catalog No. 9156 covers machine tool vises, angle vises, adjustable angle plates, adjustable lathe fixtures, safety work holders for drill presses, quick-acting vises, large-capacity mill table vises and parallel clamps. Universal Vise and Tool Co., Parma, Mich. **L-2-18**

Welding Studs

Thirty-six-page booklet on arc welding studs, pins and tapped pads for stud welding contains a complete index and reference to equipment and accessories used in stud welding applications. Specification pages list size minimums and maximums, mechanical properties, thread sizes and other pertinent data. K S M Products, Inc., Stud Welding Div., Merchantville 8, N. J. **L-2-19**

Power Tools

Catalog No. 57 provides detailed descriptions, specifications and illustrations of line of power tools for cutting, shaping, drilling and finishing wood, metal and plastics. Boice-Crane Co., 934 W. Central Ave., Toledo 6, Ohio. **L-2-20**

Grinders

Complete line of carbide tool and chip breaker grinders discussed in Catalog No. 260 which points out special features and advantages and gives specifications and dimensions; well illustrated. Hammong Machinery Builders, Inc., 1661 Douglas Ave., Kalamazoo, Mich. **L-2-21**

Universal Testing

Information and specifications for standard Electromatics universal testing machines of from 500 to 1,000,000-lb capacity, as well as comprehensive descriptions of independent loading, weighing and indicating systems featured on all models, covered in 40-page illustrated Bulletin 54; also discusses compression and XY testing machines, electronic recorders, instrumentation and accessories. Tinius Olsen Testing Machine Co., Dept. 5756 Easton Rd., Willow Grove, Pa. **L-2-22**

Gear Shaving Cutters

Twelve-page reference manual, CR.56-10, dealing with care and use of gear shaving cutters; includes cutter specification tables, mounting instructions and data on speeds, feeds, coolant, cutter life, sharpening, storage and cutter repair procedures; also gives order information, application data and a table of recommended tooth thickness stock allowances for the gear shaving process. National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. **L-2-23**

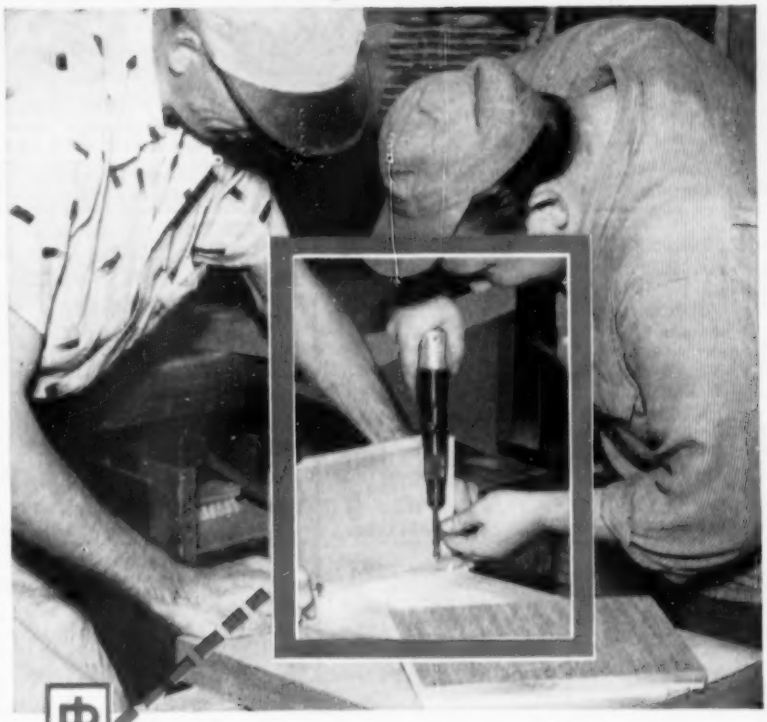
Lubrication

Automatic and semiautomatic centralized lubrication systems for wide range of small machines described and illustrated in 24-page Bulletin No. 4C, "Metered Lubrication for the Small Machines"; discusses factors to be considered in selecting proper lubricator for specific machine; also discusses distribution systems, meter units and installation details. Service, Bijur Lubrication Corp., 151 W. Passaic St., Rochelle Park, N. J. **L-2-24**

Cutting Material

Four-page folder gives specific data on cutting action of recently developed NewMet for high-velocity cutting on various steels, and carbides. Newcomer Products, Inc., Letrobe, Pa. **L-2-25**

is there a COST-SAVING *idea in this picture for you?*



air-powered screw drivers end handwork in close quarters

*Exceptionally small side-to-center distance of this Ingersoll-Rand air-powered screw driver permits running screws that electric tools can't reach and that formerly had to be driven by hand.

AIR engineering at work
REPORT No. 4211.05

The men pictured above are saving $1.35 on a single unit. That's a saving of $87.75 a day for their company. Production has increased 160% since the two men changed from a combination of electric tools and hand methods to I-R Air-Powered Screw Drivers. At this rate, the I-R tools *paid for themselves in 3½ days!*

Can you picture a similar saving in your plant? An I-R AIRengineer, with over 1000 sizes and types of air and electric tools to work with, will gladly analyze your assembly operation and make recommendations without obligation. Write today!

Ingersoll-Rand
11 Broadway, New York 4, N.Y.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-205

over 8,000 Different Cylinder SELECTIONS—

Miller

AIR AND HYDRAULIC

CYLINDERS AND BOOSTERS

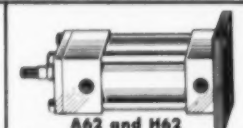
"IN STOCK" for immediate delivery...

See Miller Bulletins A-105K (Air) and H-104K (Hydraulic) for Complete Dimensions and Engineering Data on these "in-stock" sizes and other Custom Miller Cylinders in bores up to 20" and strokes up to 22 feet.

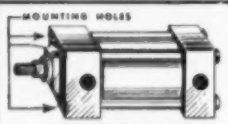
"IN-STOCK" MODELS

"A" Signifies Miller 200 psi Air Cylinders; "H", 2000 psi Hydraulic Cylinders. Interchangeable Mountings Are Shown In Red On Drawings.

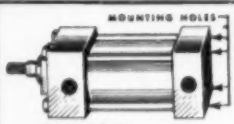
A61 and H61
Flange Mounting on Rod End
(A61 not available in 8" bore)



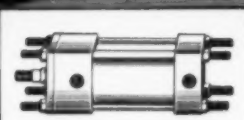
A62 and H62
Flange Mounting on Cap End
(A62 not available in 8" bore)



A63—8" Bore only
Flange Mounting on Rod End

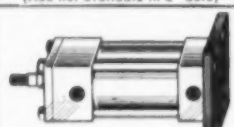


A64—8" Bore only
Flange Mounting on Cap End

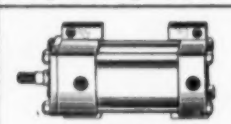


A50 & H50—Tie Rods not extended beyond nuts.
A51 & H51—Tie Rods extended both ends (shown).
A52 & H52—Tie Rods extended. Cap End only.
A53 & H53—Tie Rods Extended. Rod End only.
A54 & H54—Two Tie Rods extended at both ends.

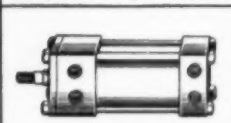
H65—Hydraulic Only
Flange Mounting on Rod End



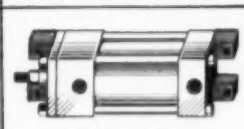
H66—Hydraulic Only
Flange Mounting on Cap End



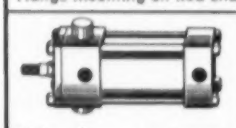
A72 and H72
Side Lug Mounting



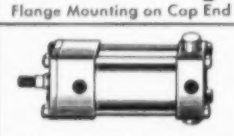
A74 and H74
Side Flush Mounting



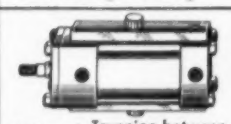
A77 and H77
Side or Foot Mounting



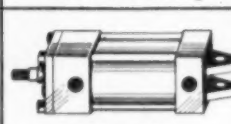
A81 and H81 Trunnion Mounting on Rod End



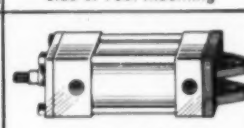
A82 and H82 Trunnion Mounting on Cap End



A83 and H83 Trunnion between Head and Cap
(one week delivery)



A84 and H84
Pivot Mounting



A86 and H86
Pivot Mounting

IN STOCK BORES in Inches

"IN-STOCK" STROKES (in Inches)

	Bores	Rod Dia.	Rod Turn Down & Threads		1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
AIR	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	6	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	8	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
HYDRAULIC	1½	⅝"	7/16-20	Cushioned			3	4	5	6	7	8	9	10	11	12									
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12									
	2	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	2½	1"	¾-16	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	3¼	1⅜"	1-14	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	4	1¾"	1¼-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
	5	2"	1½-12	Cushioned			3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36
				Non-Cush.	1	2	3	4	5	6	7	8	9	10	11	12	14	16	18	20	22	24	28	32	36

(1) "A" and "H" Models 82, 84 and 86 with strokes over 18" require stop tubes.

Column strength requires larger diameter piston rods for the following:

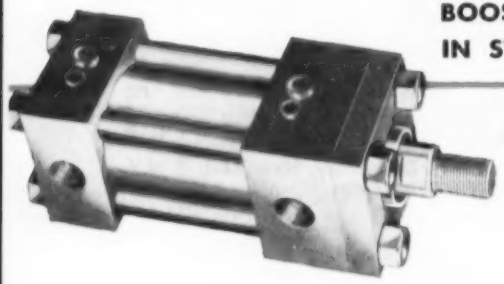
Air Cylinder Models A82, 84, and 86 with strokes inside area (1), when operated at 100 psi and over;

All hydraulic models with strokes inside area (2) and Models H82, 84, and 86 with strokes in area (4), when operated at 2000 psi and over;

(4) Models H82, 84 and 86 with strokes inside area (3), when operated at 1000 psi and over.

(3) Depending upon Trunnion Pin location, "A" and "H" Models 83 with standard diameter piston rods can have longer strokes than Models 82, 84 and 86.

(2) See Miller File #251 for oversize piston rod and stop tube requirements.



BOOSTERS IN STOCK

Immediate Delivery on the following Miller 25 to 1 Ratio Boosters (80 psi air input produces 2000 psi hydraulic oil output): Model B4, 5" bore, 1" dia. ram, 6" and 12" strokes; Reciprocating Booster Model DA77-RBA8, 5" bore, 1" dia. ram, 6" stroke. Also Booster Tanks, 5" dia., 6" and 10" heights.

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Miller

MILLER FLUID POWER DIVISION
FLICK-REEDY CORP.

2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

FIELD notes

Norton Co. has been authorized by the Atomic Energy Commission to exchange information and services under the United States bi-lateral agreement with Canada for cooperation concerning civil uses of atomic energy. Five U. S. companies are now authorized to exchange such data with Canada. Norton's authorization refers to services with respect to technology of fabricating control rods, shielding materials, ceramic fuel elements, and crucibles insofar as they relate to the NRU, NPD, NRX and PTR atomic reactors.

V V V

Cone Automatic Machine Co., Inc. has taken over manufacturing and sales rights of the H. E. B. Pilot automatic copying lathe for the United States and Canada under a licensing agreement with H. Ernault Batignolles of France. The machine, to be known as the Conomatic Pilot, will be sold through the Cone sales organization.

new companies

Decision to form a new company to produce and sell titanium metal has been reached by Allied Chemical & Dye Corp. and Kennecott Copper Corp. The new company, which will be equally owned by the parent corporations, calls for an initial investment of $40-million. Production of titanium tetrachloride, titanium sponge and titanium billets is expected to start late in 1958. Site of the facility is expected to be announced shortly.

V V V

Formation of the Union Carbide Research Institute to engage in basic scientific research has been made public by Union Carbide and Carbon Corp. The center will be located on the corporation's Westchester property near Tarrytown, N.Y. It will be under the administration of Dr. Augustus Kinzel, vice-president-research of Union Carbide, while Dr. E. R. Jette, formerly head of the chemistry and metallurgy division at Los Alamos Scientific Laboratory in New Mexico, has been named director.

Major purpose of the Institute, which is scheduled for completion by spring of 1958, will be to contribute to the store of fundamental knowledge by studying physical and chemical behavior of matter under ordinary as well as extreme conditions of pressure and temperature.

corporate changes

Arrangements for the merger of interests of Sheffield Corp. with those of Bendix Aviation Corp, have been completed. Under the new setup, Sheffield, which retains its corporate name, will continue to operate under its present management as a wholly-owned subsidiary of Bendix Aviation. Louis Polk, who will continue as president of Sheffield, will become a director, vice-president and group executive of Bendix.

V V V

Assets of The Gairing Tool Co. have been sold to the Ernest Kanzler interests according to announcement by Eugene Bemb, former president who is retiring from active business. The name of Gairing Tool Co. will be retained by the new interests and the firm will continue active in the cutting tool industry. Don F. Morse was made vice-president and general manager, Bernard M. O'Meara was elected vice-president, and William B. McClellan continues as general sales manager. Both Mr. O'Meara and Mr. McClellan are members of ASTE's Detroit chapter.

V V V

Flexonics Corp. has purchased the Flex-O-Tube Div. of Meridan Corp. in order to offer a complete line of flexible hose products of all materials for industrial use. Flex-O-Tube will continue normal operations as a division of Flexonics with no change of personnel.

V V V

The Bullard Co. has acquired the complete line of Hydra-Feed lathes from the Hyra-Feed Machine Tool Corp. Manufacture, sales and service of the automatic lathes will now be handled in the Bullard plant in addition to its regular line of machine tools. They will be sold under the name of Bullard Hydra-Feed lathes.

V V V

Acquisition of Cadillac Gage Co. of Roseville, Mich., and Smith Bearing Co. of Trenton, N.J., has been announced by Ex-Cell-O Corp. Both firms, which became wholly owned subsidiaries of Ex-Cell-O, will operate as separate units under their existing managements.

V V V

Hudson T. Morton has sold his stock interest in Morton Bearing Co. and resigned as president and general manager. Roscoe O. Bonisteel, Jr., has been elected president of the firm.

new facilities

With its transmission production surpassing the 140,000 mark, the new Kokomo plant for three-speed automatic transmission production, was officially opened by Chrysler Corp. The manufacturing building, which is equipped with the most modern automatic machines, covers 16 acres under a single roof. A two-story administration building covers an additional 50,000 sq ft. This construction is part of the company's five-year, billion-dollar expansion program.

V V V

Dana Corp. plans construction of a central office and warehouse for its Parts Div. The building, with 150,000 sq ft of floor area, will provide space for an expanding and research department and for manufacturing activities of its Toledo Div. which then will occupy the space presently devoted to the Parts Div.

V V V

Dedication ceremonies officially opened the Huntsville, Ala., plant of Norton Co. where a variety of electric furnace materials including boron carbide, fused zirconia, fused magnesium oxide and fused alumina will be manufactured. Facilities for making aluminum oxide and silicon carbide may be added eventually. The new plant, operated by the company's Electro-Chemical Div., employs about 60 persons at present.

V V V

Eight of the 28 major press lines in the new Chrysler Corp. Ohio stamping plant at Twinsburg are expected to be operating by February with partial production underway. Altogether, 260 presses will be installed in the new facility. When the plant is in full pro-

duction 3,500 persons will be employed. The manufacturing building is scheduled to be completed in May although the overall building project is not expected to be finished until next summer.

V V V

H. K. Porter Co. Inc. has scheduled building of a chemical plant in Pascagoula, Miss. to produce magnesia and basic refractory products. The plant, which will cost an estimated $8-million, is to be completed by early 1958.

A new mill branch warehouse and office has been opened in Houston, Tex., by The Carpenter Steel Co. to provide service to users of specialty steels in the Southwest. Charles E. Miller, will be in charge of the warehouse.

V V V

Plans for construction of a modern plant to house the Warner Automotive Parts Div. of Borg-Warner Corp. in Auburn, Ind. has been announced. Construction of the 162,000 sq-ft structure is scheduled to start next spring while full occupancy is expected by next fall. It will permit consolidation under one roof production operations that currently are occupying several of the company's old buildings.

V V V

Link-Belt Co. has revealed plans for a new plant in Montebello, Calif., to replace and expand its facilities at 361 S. Anderson St., Los Angeles. The plant, which will be started next spring, is scheduled for completion and operation by November. It will more than double the company's present manufacturing facilities in the Los Angeles area and also will house the factory branch store and district sales office.

V V V

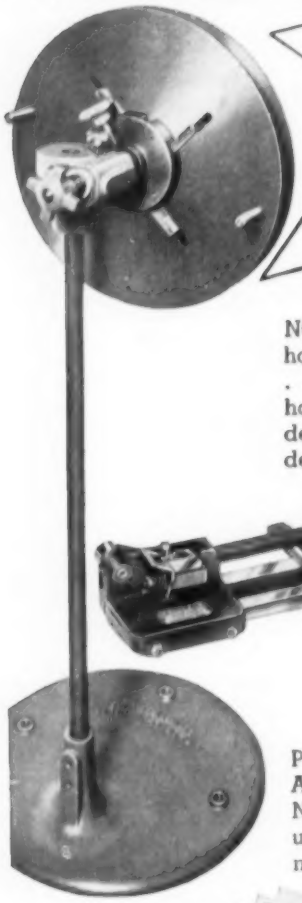
Kennametal Inc. has begun full scale production in a new plant recently completed near Latrobe, Pa. The new facility, which houses the company's special products grinding department, provides 24,000 sq ft of floor space.

HITCH YOUR HITCH FEED® TO . . .

the NEW Dickerman *STOCK REEL!*

NOW, one versatile stock reel is capable of handling a wide range of standard coil sizes . . . 16", 20" and 24" and is available to handle coils up to 36" diameter. Specifically designed and "shop tested" for use with the dependable Dickerman Hitch Feed,® this new reel will easily handle all coils conventionally used with a hitch feed!

You'll be days and dollars ahead with this precision-production Hitch Feed, Stock Reel team.



PORTABLE from one press to another . . . Accommodates coils from ¼" to 2½" widths. New coils of stock may be loaded in minutes! The reel is equipped with frictionless needle bearings, is self centering, and has a brake to control de-reeling speed.

PUT AUTOMATION TO WORK—CONSULT DICKERMAN! Send for literature and prices . . . NOW!

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H. E. DICKERMAN MFG. CO.

321-314 Albany Street, Springfield, Mass.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-208

moves

General offices of Acme Steel Co. have been moved to 135th & Perry Ave., Chicago 27, Ill. This move completes the company's consolidation of administrative, manufacturing, sales, service and office facilities in Riverdale.

V V V

Detroit office of Landis Machine Co. has been moved to 12806 Fenkell Ave.

V V V

All activities of Lindberg Engineering Co.'s Buffalo territory office is being relocated in the company's new sales facilities at 146 University Ave., Rochester 5, N.Y.

V V V

Sales headquarters of Crucible Steel Co. of America has been moved from New York City to Pittsburgh to provide increased coordination of activities of the division and improve customer service.

awards

Two awards were recently announced by the American Welding Society to recognize outstanding accomplishments in welded designs. They were established by A. F. Davis, vice-president and secretary of the Lincoln Electric Co., and will be known as The A. F. Davis Silver Medal Awards. Annually the awards of a silver medal and certificate will be given to the author of the paper selected by AWS Committee on Awards as the best contribution

to progress of welding in the field of structural design. A similar silver medal and certificate will be made to the author of the best paper in the field of machine design. Initial award period will cover the 1957 calendar year.

√ √ √

All stamping designers are eligible to enter the John Woodman Higgins Redesign Award being sponsored by Pressed Metal Institute. The award is made in commemoration of the 50th anniversary of Worcester Pressed Steel Co. and honors John Woodman Higgins, Worcester's chairman of the board.

Three criteria will be used in the competition: Successful stamping production of a part previously manufactured by another process; originality of design; and significant production cost savings as compared to the other process previously used. Winner of the award will receive a trip to Cleveland during March plus $500.

expansions

The board of Crucible Steel Co. of America has earmarked $25-million for new plant facilities which will include replacement and modernization projects. This is in addition to the capital program of $20-million now under way. Although some increase in capacity is anticipated, the program is aimed primarily at obtaining equipment for cost reduction and quality improvement.

√ √ √

The Carborundum Co. will build a multi-million dollar plant in Van Wert, Ohio for manufacture of high volume, small abrasive wheels. The facility, scheduled for completion late in 1957 and for full operation by the end of 1958, is part of Carborundum's $30-million modernization and expansion program outlined for the next two years.

√ √ √

Plans for new building additions at The Skinner Chuck Co. involve an extra 20,000 sq ft of production and storage space and 6,500 sq ft of space for the expanding engineering department.

√ √ √

Construction is under way on a 17,000 sq ft addition to the St. Thomas Works of Canadian Allis-Chalmers Ltd. which will provide increased production and improved shipping and receiving facilities. It is scheduled for completion by March 1957.

√ √ √

The Timken Roller Bearing Co.'s Steel and Tube Div. has completed a $1¼-million expansion program for its tube mill. The facility now is capable of producing alloy seamless tubing 40 ft in length weighing up to 3500 lb. A storage building, rotary sizing mill, cooling and reheat furnaces and installation of industrial television control systems for regulating flow of tubing into various furnaces and cooling units were part of the tube mill expansion program.

√ √ √

Through acquisition of new equipment and additional facilities, The Federal Machine and Welder Co. has expanded its plant capacity to produce by approximately $1½-million annually according to company president, A. S. Bladgen.

name change

Name of A. Milne & Co. became A. Milne & Co., Inc. on the 70th anniversary of its founding, January 1, 1957. Officers of the new corporation are H. S. Hoyt, president; J. King Hoyt, Jr., executive vice-president and treasurer; James King Hoyt, vice-president; W. Metze, controller; and James E. McGrath, secretary and assistant treasurer. J. King Hoyt, Jr. is a member of ASTE's Golden Gate chapter.

√ √ √

Corporate name of The Parker Stamp Works, Inc. has been altered to The Parker-Hartford Corp. According to the company the change was made to avoid confusion which has existed since it began expanding into new fields.

distributors

The W. H. Nichols Co. has appointed The Robert E. Morris Co. as its national distributors under direction of Robert E. Morris, president, and John E. Bashforth, vice-president. The policy of distribution by recognized local machine tool dealers will be continued. Mr. Morris and Mr. Bashforth are members of ASTE's Hartford and St. Louis chapters respectively.

√ √ √

To offer broader national sales and service, Speed-D-Burr Corp. has made an agreement with Minnesota Mining & Mfg. Co. to distribute its complete line of barrel finishing equipment and supplies through the network of distributors now operating under the 3M name.

√ √ √

Recent announcement from Automatic Switch Co. has made public its appointment of two new distributors: McKeever Electric Supply Co., 212 N. Grant Ave., Columbus, Ohio; and Westinghouse Electric Supply Co., 2538 Poydras St., New Orleans, La.

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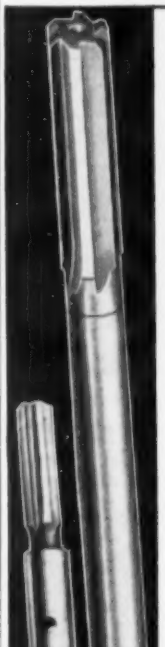

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FAST MACHINING is assured by high speed wet or dry abrasive belts, backed by a ground steel platen. Controls are pre-set for feed and pressure. Quick approach of ball-bearing table is followed by hydraulically controlled in-feed down to Micro-Stop limit. Eliminates waste . . . cuts cost. New design incorporates larger pump and coolant capacity with easier access for clean-out. Redesigned one piece frame plus wrap-around splash guard.

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Automatic Table Surface	13" x 28"
Capacity	9" x 11½", 15½" or 17½"
Abrasive Belts	8" or 9" x 107"
Drive Units	5 or 7½ HP
Belt Speeds	(5 HP) 4100 SFPM standard; 2550, 3550, 4600 optional (7½ HP) 5000 SFPM standard; 2500, 3500, 5500 optional
Coolant Capacity	85 gallons
Overall Dimensions	Height 72½"; width 44"; depth 48"

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Ceramic Tool Tips

In an article in the French periodical *Machine-Outil Francais* of September 1956, E. Blanpain discusses the advent of ceramic tool bits, asking whether they will lead to important changes in the metal-cutting field. In his opinion, the relatively high coefficient of expansion of ceramic tips reduces the risk of cracking during brazing to the tool shank, while their brittleness makes vibration-free and rigid machine tools more necessary than ever. The absence of the built-up edge makes possible producing workpieces with high surface finish. Ceramic tips require diamond wheels for regrinding.

Another article on ceramic tools published in a French magazine *La Machine Moderne* gives an experimental comparison with carbide tipped tools and shows the high wear resistance of ceramic tools. The author, W. B. Kennedy, reports that dry grinding with 150 to 350-mesh diamond wheels gave the highest finish. He is also of the opinion that the new machine tools of the future must be vibration-free and rigid. They must also be powerful to allow high speeds and feeds.

Chip Removal from Fixtures

Removal of chips produced in the machining of workpieces is time consuming and unproductive. Hence, it is desirable to design fixture and jigs so chips do not accumulate but are kept moving by gravity or coolant or both. M. Tingelhoff has studied the problem of designing so-called "chipfree fixtures." He reports on his ideas and designs in Issue No. 11, 1956 of *Werkstattstechnik und Maschinenbau.*

Horizontal surfaces in the path of dropping chips should be avoided and inclined surfaces used instead. The angle of inclination of such surfaces is significant for satisfactory chip disposal and must be adapted to the material of the workpiece to be machined.

The author has determined the minimum angle of inclination that the sur-

faces may have and at which the chips would move under gravity. Fine chips of cast iron slide down surfaces inclined 35 deg; coarse cast-iron chips move on surfaces with 30-deg inclination.

Short chips of steel with some oil on them require an inclination of the surface of 50 deg, while long and wet chips of steel will move when the surface has an inclination of only 25 deg. Fine aluminum chips need surfaces of 40-deg inclination while coarse aluminum chips need an inclination of 45 deg.

Since angle of inclination affects height of the fixture, this must be given attention also. It will not always be possible to build fixtures with the proper slope but the designer should try to design for the optimum angles indicated.

The author differentiates between so-called "roof type surfaces" in fixtures (inverted V) where the chips can move in two directions and simple inclined surfaces with a single direction of motion. The article is illustrated with examples of fixtures for drilling and milling operations designed for chip disposal.

Turning of Workpieces with Multiple Corners

Turning of workpieces with rectangular, hexagonal and similar cross sections can be based on rotation and advance of multiple toolhead-carrying turning tools and combining turning, milling and planing motions. The new method is described by R. Clar in the November 1956 issue of *Werkstattstechnik und Maschinenbau.*

Inexpensive tools and short machining times are among the features of this machining operation. Setting and grinding of the tools is simple and indexing is not required, as in the case of milling of hexagonal or similar shapes.

The tool performs two main motions; namely, turning about its own axis and rotating in a planetary fashion around the workpiece. In older methods, which were unsuccessful, both the workpiece and the tool rotated about their respective axes. The path described by the point of the tool is an ellipse of such length that a straight line is approximated with sufficient accuracy.

The author outlines the principal motions in great detail and shows that the sides of a square of about ½-inch width will be straight within 0.0004 in., while the accuracy of a square of 1¼-in. width is about 0.010 in. In hexagonal shapes the straightness of the sides is considerably better for larger sections; namely, of 0.0036 in. and above.

The cutting speed of the tools is not constant along their elliptical path but varies between a maximum and mini-

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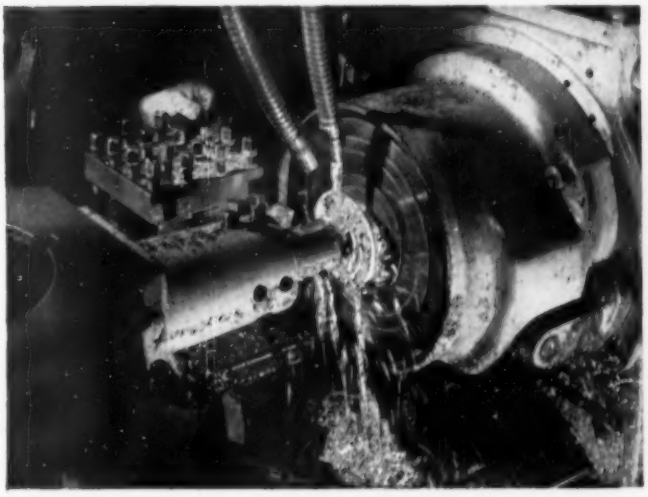

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mum value. Likewise, the angle of inclination and the rake angle change periodically during cutting from negative to positive and back to negative. Similar periodic changes occur in the depth of cut. Tool life is good and surface finish satisfactory. The method is used in special machines for manufacturing nuts at a cutting speed of about 750 sfpm and a production time of 15 sec. for the larger sizes.

Cracks and Stresses in Carbide Tips

An interesting investigation of the stresses occurring in carbide tips by G. Vieregge is described in the November issue of *Werkstatt und Betrieb*. From this study it can be concluded that tension in the tip can reach values as high as 170,000 psi in the case when the carbide tip is as thick as the supporting portion of the steel shank.

The stress rapidly drops to zero when a ratio of 3:1 of the thickness of the supporting portion of the shank to the thickness of the tip is maintained. Upon further increase in the ratio, to 4:1, compression stresses are developed in the carbide tip of about 43,000 psi. These figures show how important it is to watch the thickness of tip and supporting tool shank.

These stresses are due to the difference in the coefficient of expansion of carbide and steel; steel expands and shrinks considerably more than carbide.

The author has also investigated stresses existing in the solder and came to the conclusion that no shear stresses greater than those in the solder can exist. Hence, when two metals of unequal coefficients of expansion are to be soldered, it is desirable to use low strength solder, in contrast to joining two metals of the same coefficient of expansion, where high-strength solder is desirable.

Silver has a high shear strength of about 35,000 psi. while that of copper is only 25,000 psi. For this reason, copper is better than silver for joining carbides to steel shanks. The author indicates also that better solders could be developed based on each particular type of carbide.

World-wide management consulting service to Canadian, European, Middle Eastern and Far Eastern business and industry is offered by the newly formed company, George Fry & Associates. Coordinating headquarters for the overseas operation will be maintained in New York. A Toronto office has been established to supervise Canadian business consulting projects, and an office in Frankfurt, West Germany, is being set up to centralize operations in Europe.

who's meeting and where

Feb. 15-16. National Society of Professional Engineers. Spring meeting, Hotel Francis Marion, Charleston, S.C. For other facts write to society headquarters, 2029 K St., N.W., Washington 6, D.C.

Feb. 19. Rochester Society for Quality Control. 13th annual quality control clinic, War Memorial, Rochester, N.Y. Obtain details from Thomas J. Soebbing, Eastman Kodak Co., Navy Ordnance Div., 50 Main St., West, Rochester 14, N.Y.

Mar. 6-8. Pressed Metal Institute. Spring technical meeting, Hotel Carter, Cleveland, Ohio. Request information from institute headquarters, 3673 Lee Rd., Cleveland 20, Ohio.

Mar. 11-15. Nuclear Congress and Atomic Exposition, Convention Hall, Philadelphia, Pa. Data is available from exposition office, 304 Architects Bldg., Philadelphia 3, Pa.

Mar. 14-16. The Society of American Military Engineers. Third military-industrial conference. Conrad Hilton Hotel, Chicago, Ill. Direct inquiries to society office, 808 Mills Bldg., Washington 6, D. C.

Mar. 18-19. Steel Founders' Society of America. 55th annual meeting. Drake Hotel, Chicago, Ill. Direct inquiries to society office, 606 Terminal Tower, Cleveland 13, Ohio.

March 18-21. The Society of the Plastics Industry, Inc. Annual national conference and Pacific Coast Plastics exposition, Hotel Biltmore and Shrine Exposition Hall, Los Angeles, Calif. For more information, contact society office, 250 Park Ave., New York 17, N. Y.

Mar. 25-29. American Society for Metals. Western metal exposition. Pan-Pacific Auditorium, Los Angeles, Calif. For complete data, contact ASM offices, 7301 Euclid Avenue, Cleveland, Ohio.

Apr. 3. Society of Plastics Engineers, Inc. Regional technical conference, "Plastics for Building," New York City. Direct inquiries to society office, 34 E. Putnam Ave., Greenwich, Conn.

Apr. 7-12. American Chemical Society. Spring meeting, Miami, Fla. Further facts are available from society office, 1155 Sixteenth St., N.W., Washington 6. D.C.

Apr. 9-11. American Welding Society. Fifth welding show, Convention hall, Philadelphia, Pa. Obtain more data from exposition management, Robert T. Kenworthy, 12 E. 41 St., New York 17, N.Y.

Apr. 14-27. First U. S. World Trade Fair, New York Coliseum, New York, N.Y. Write U.S. World Trade Fair, 331 Madison Ave., New York 17, N.Y. for more details.

Apr. 29-May 3. Materials Handling Exposition, Convention Hall, Philadelphia, Pa. Data may be had from exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y. Concurrently, the American Material Handling Society will hold a conference on new developments in handling methods.

April 30-May 1. Metal Powder Association. Thirteenth annual meeting and 1957 Metal Powder Show. Drake Hotel, Chicago, Ill. Contact association office, 130 West 42nd St., New York 36, N. Y., for further information.

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Tech Digests

When to Automate Assembly Operations

By G. R. Fitzgerald

Director
Process Development Staff
General Motors Corp.
Detroit, Mich.

ASSEMBLY WORK in most industries has been traditionally manual. Where assembly accounts for a large portion of manufacturing costs, many successful attempts to mechanize the system have proved it to be a fruitful field for cost-reduction. This may lead many to believe that automation of assembly, *Figs.* 1 & 2, has promise of application to the solution of an extremely wide range of production problems.

However, in its present stage of development, this is far from the truth. Automatic assembly is not always the best solution from an economic standpoint. In fact, experience at General Motors has led to the belief that the greatest problems in the use of automatic assembly equipment are economic rather than mechanical. If the economics of an assembly situation are favorable for automatic assembly, mechanical problems involved can usually be solved.

There are a number of qualified special-machine builders who have demonstrated competence in development of special assembly equipment. They will readily accept responsibility of solving equipment-design problems involved.

Responsibilities for economics still rests with the buyer, and to insure wise investment of tooling and equipment budget, he must be sure he is getting the greatest economic gain with the least added investment. This can be accomplished only by considering many optional plans.

The development of alternative solutions begins with the study and analysis of costs with the existing method, as cost records do not always correspond to factory procedures. The next, and most important, step involves a thorough and complete study to determine how existing facilities can be used to maximum efficiency.

One fact usually borne out by such studies is that, as the ultimate in mechanization is reached, equipment costs increase at a much more rapid rate than the decrease in labor costs. This explains why some manual operations exist on many machines developed in the process development group. Also why assembly machines are more truly described as semi-automatic. It further explains why total automatic operation can be justified only with proper combination of simple operations, high production schedules and a product not subject to frequent engineering or model changes.

The process development group operates as one of four central office technical staff groups located at the General Motors Technical Center. It was established mainly to assist the thirty-two operating divisions of the company in developing improved manufacturing technics. Its relationship is that of an independent research group or special machine supplier.

The group has been asked by many of the divisions for assistance on assembly problems. A number of these have resulted in design and building special assembly equipment. For example, *Fig.* 1 shows a special machine developed to assemble components of an automotive spark plug. Possible damage to the insulator assembly is avoided by manual insertion.

Another machine developed in cooperation with Detroit Transmission Division is illustrated in *Fig.* 2. This machine provides for assembly of 12-inch-diameter turbine assembly as shown. The 36 turbine vanes are loaded into the sheet metal shell on individual automatic machines located adjacent to the main assembly machine, *Fig.* 3. This provides automatic drilling, reaming, and deburring of rivet holes; loading and staking of rivets, spinning of vane tabs to hold the vanes in position, crimping of vanes to hold inner shell in place, and dimensional inspection of the finished assembly.

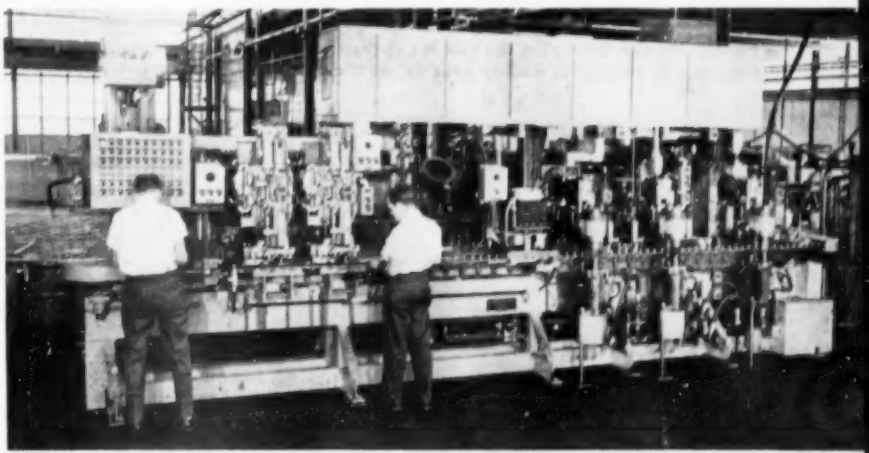


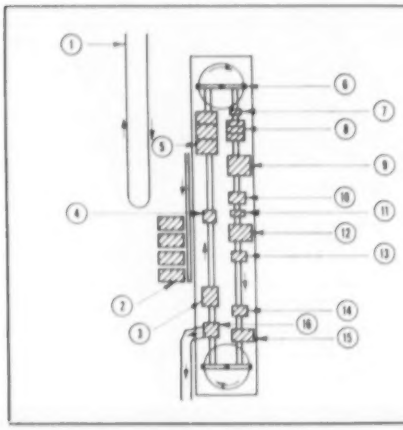
Fig. 1. Process development engineers test machine to assemble components of spark plug. The only manual operation is loading of insulator assembly.

Fig. 2. Loading station of automatic assembly machine for producing torus for use with hydramatic transmission. The assembly machine is 75 ft. long.

Obviously, design consideration in automatic assembly equipment is a subject in itself. However, economic considerations are of much greater initial importance to potential users of such equipment. Consideration of design details should come only after complete and thorough study of the economics of the situation.

In particular it is necessary to be sure that one does not over mechanize simply because of the belief that "because it is automatic, it must be good." Rather, each situation should be explored to give the best practical balance between equipment investment and cost savings. Or, breaking the complete assembly sequence down into its parts, each part should be equally self-supporting from an economic standpoint.

From a paper given at the November, 1956, American Society of Mechanical Engineers annual meeting, 29 W. 39th St., New York, New York.



1. Overhead conveyor for vane shells
2. Automatic vane loading machines
3. Operator loads carriers or hubs
4. Operator loads spacers
5. Drill, probe & deburr
6. Turn around
7. Chip removal
8. Load rivets & probe
9. Head rivets
10. Operator loads inner shell
11. Press inner shell
12. Spin vane tabs
13. Crimp inner shell
14. Bend vanes
15. Gage assembly
16. Plug process holes & eject

Fig. 3. On the floor plan the process operations for assembly of the torus are in sequence as indicated, ending with automatic balancing in a succeeding process.

▼ ▼ ▼

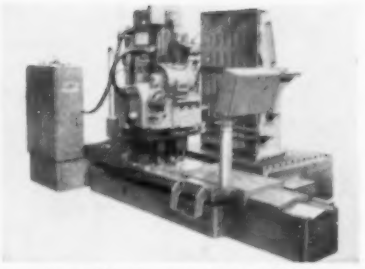
Engineering's Role in Management

By J. E. Ritchey

Associate Professor
Industrial Management
Purdue University
Lafayette, Ind.

Before one can even begin to discuss engineering as a function of management, it is necessary to know where the company is headed. Simply stated it is not the purpose of a business, but the obligation to make a profit. Every function of management must be defined and engineering is no exception. This definition must be in the light of the purpose of the company.

The chief engineer should assist his superior and the management in general by formulating and recommending engineering policy. This would include policy on maintenance, plant construction, product development, process design and technical service. In fact it would include determination of the duties and responsibilities being discussed. Second, he must provide fore-



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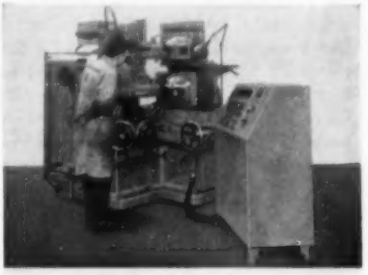

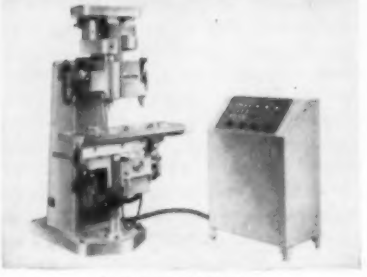

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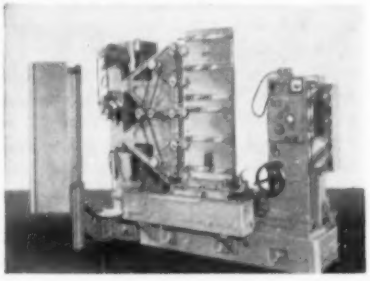

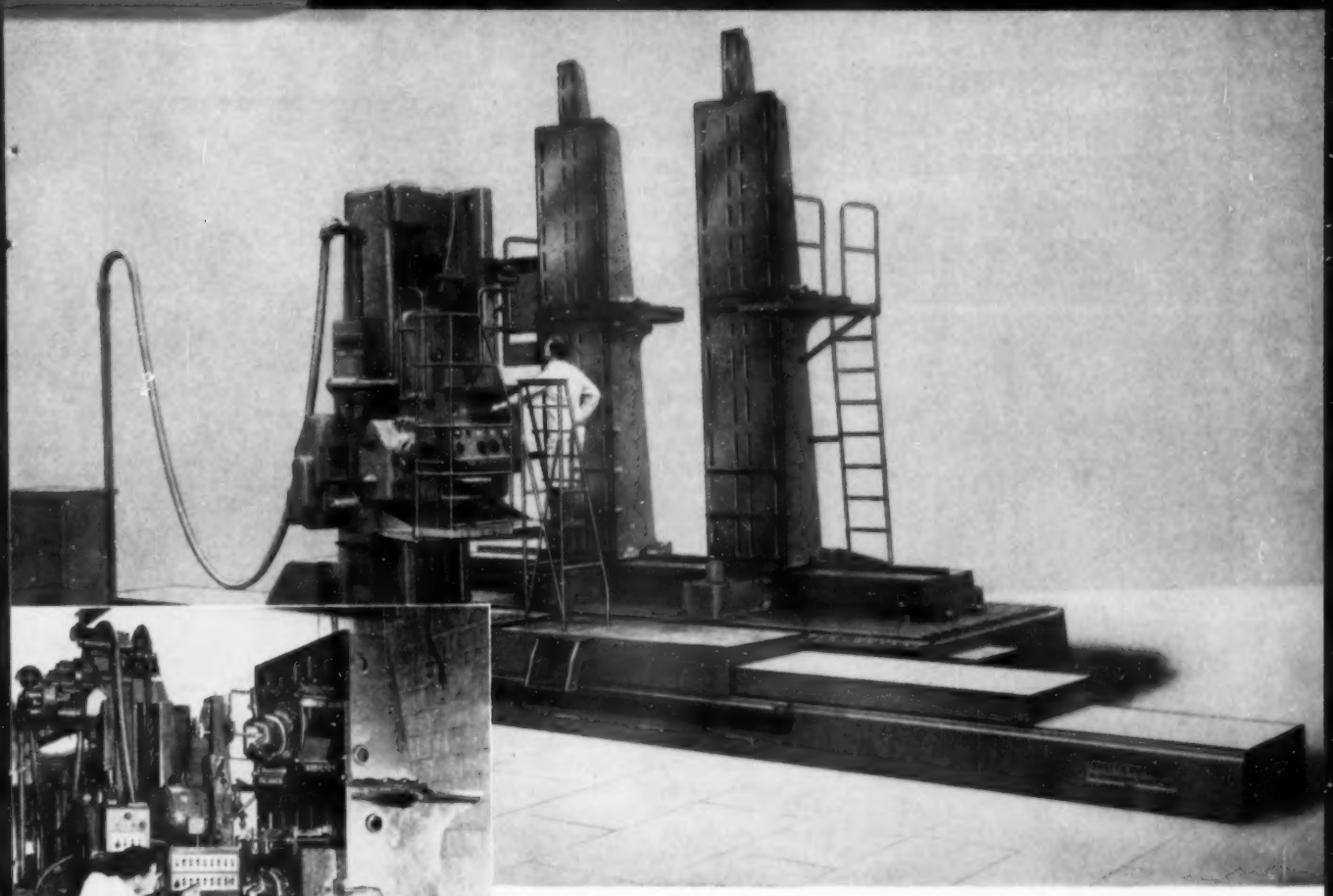

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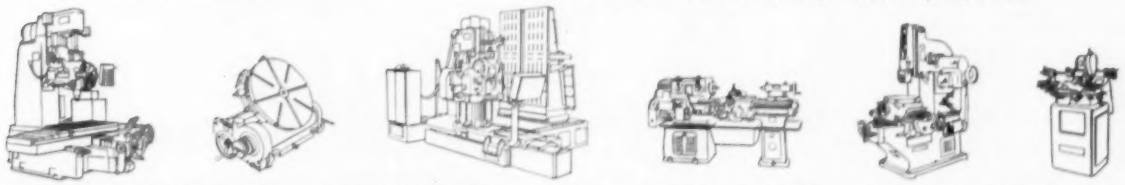

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tech digests

going services agreed upon. This involves setting up of maintenance department, design and development sections, drafting department and the like.

Another responsibility is that for organizing. This includes getting results through others. This is a responsibility for organizing groups, departments and people so as best accomplish the task outlined. Services performed must be adequate, including the economic one.

Another responsibility is to provide engineering service to the various manufacturing departments. This is rather broad. Fundamentally, it stems from the fact that engineering is a staff activity and exists solely for the purpose of aiding manufacturing operations.

Another responsibility is to advise and assist in alteration of the company's line of products. This includes addition of new products, modification of old, and possibly elimination. This work cannot be divorced from dealing with process design and development. It is necessary to find an economical way to make an item. Another responsibility is to procure and develop competent men for the engineering group. This is a real problem because of the shortage of engineers.

Hiring engineers is one thing. Developing them is another. A good training program is needed for the latter.

Equally important is some kind of guidance or appraisal system, whether it is merit ratings, yearly interviews or something else. Every person who works for someone else deserves to know how he is doing. For too long, engineers have been expected to thrive on professional status.

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Another portion of development program would include attendance at meetings, going to conferences, reading books and magazines, and visiting plants. These tend to stimulate thought and give engineers opportunity to develop. A final responsibility is for the chief engineer to reserve enough of his own time to think about the future: future of his department and of the company's products, future of design work and future of his men. This responsibility often is overlooked but a chief engineer can't afford such an attitude—too much depends on his performance.

From a paper given at the ASME annual meeting, New York, New York, November, 1956.

▼ ▼ ▼

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INDICATE A-2-218-2

Labor's Stake in Manufacturing Improvements

By Robert K. Lohman
Pittsburgh Steel Products Div.
Pittsburgh Steel Co.
Pittsburgh, Pa.

Management and labor share the responsibility for increasing efficiency of operations—management to stay in business and labor for its own sake to help the company stay in business. Experts say that production must be increased 40 percent to meet consumer demands by 1966. Hand-in-hand with this prediction are two important forecasts. One is that more money must be spent on material handling. The other is that employment will continue to rise.

To gain benefits offered by improved material handling, the full meaning must be made clear to the average worker. After an improvement involving use of material handling equipment has been proposed and management has okayed it, the job is still unfinished. It is necessary to explain to the worker what the new equipment means, why it is being introduced and why it is not a threat to his job. He must be informed that it will take men to operate the new equipment, usually at a higher pay classification.

Another important fact to the worker, which is usually overlooked, is that 25 percent of all industrial accidents are traced to men who handle materials manually. When machines do the lifting, pulling and moving, the chances of accidents are greatly reduced.

To sell suggestions on improvements to management, first show how the company will get a return on its investment. After lining up the pros and cons of cost outline which method will do the job better. If the proper figures back up the proposal, chances are that management will see things that way.

From a talk given before the National Metal Trades Assn. Material Handling Clinic, the Material Handling Institute, Inc., Pittsburgh, Pa., October, 1956.

▼ ▼ ▼

"Your drawing still has a few bugs in it, Hoskins. See if you can get them out!"

Automation and the Product Engineer

By A. E. W. Johnson
Vice President—Engineering
International Harvester Co.
Chicago, Ill.

From an engineering standpoint, International Harvester has three objectives: to provide products of maximum utility and value to our customers in relation to a sales price yielding a profit, to maintain and enhance our company's competitive position through advanced engineering design, and to achieve maximum economy in manufacturing by development of products within the limits of financial and commercial requirements.

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neer's knowledge of the manufacturing methods to be employed if he is to translate his designs successfully into a commercially finished product. It is generally accepted that the product design determines, to a large degree, the tools and techniques used in manufacturing.

Design for Automation

Therefore, if quality parts are to be produced at a competitive cost, they must be engineered to permit the manufacturing plants to take full advantage of the most productive tooling and processes available. It is mandatory, therefore, that product engineering have knowledge of, and ability to create, designs utilizing the latest developments in machine tools, equipment and other advanced manufacturing techniques. It is likewise essential that advanced mechanization or automation be considered and fully evaluated in engineering our products of tomorrow if our company is to advance in this aggressive and competitive economy.

The new manufacturing techniques and processes, made possible with automation, will permit greater latitude in design. Parts can be economically manufactured to closer tolerances through the use of new types of gages and controls that will often permit designs either impractical or impossible in the past. Moreover, automatically controlled equipment minimizes the build-up of tolerances and will, in many instances, avoid the need for selective assembly.

To achieve the maximum benefit from these techniques, our engineers must design toward their use. They must be fully informed regarding both availability and economic advantages of automated equipment. Obviously, engineering and manufacturing must maintain the closest liaison in the various stages of product development to make certain that the engineering design will be adaptable to planned manufacturing and tooling methods.

In addition to specific design requirements, adequate production and stability of design are important considerations to the successful and economic use of automation. The extent to which these advanced manufacturing techniques may be employed will depend largely upon the production rate and life expectancy of the products in question. Thus, accurate forecasting and sales analysis are essential prerequisites to the intelligent selection of automated equipment.

In this era of scientific and technological progress, the work of the design engineers becomes more challenging. Engineering design and testing must be analyzed and evaluated as never before, both from the standpoint of ultimate customer use and profit objectives, if our engineering objectives are to be achieved.

From a paper delivered at the 1956 International Harvester Co. technical conference, "Progress Through Automation." The International Harvester Co., 5225 S. Western Blvd., Chicago, Ill.

▼ ▼ ▼

New Materials Make Up Plastic Sandwich Construction

By G. D. Miller
and
H. J. Waite
Plastics Technical Service Dept.
Dow Chemical Co.
Midland, Mich.

The need for stronger lightweight materials has resulted in sandwich construction. In this design, existing materials are incorporated into a component having relatively high strength and weight.

In the truest sense, sandwich construction is a three-ply laminate in which the core material is different from the facing material in composition or structure and is bonded to the facings so that every component functions in a structural capacity. The low density core in a panel is to stabilize and position relatively thin high-density facings so that the major applied loads are borne by these facings.

During the past 10 or 15 years, chemical technology has developed various plastic materials which lend themselves particularly well to the high-strength, lightweight requirements of panel construction. Plastics finding application in panel components are as follows:

Core—foamed thermoset and thermoplastic materials include polystyrene, cellulose acetate, phenolic, di-isocyanate, polyester and silicone

Facings—laminates of polyester, epoxy, phenolic, melamine and urea with glass fiber, paper and cotton duck as reinforcing

Adhesive—both thermoset and thermoplastic materials. In particular, the thermosets find much use in structural panels. These include phenolics, resorcinols, epoxies and urea formaldehydes.

Combinations of these plastic materials with each other and with nonplastic components have given the engineer considerable flexibility in panel construction. Panels with particular characteristics suited for residential, com-

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mercial, industrial and military capacities are being made. As design knowledge increases and choice of materials becomes even greater, the tremendous potential in these fields will be realized.

From a paper given at the 1957 St. Louis technical conference of the Society of Plastics Engineers, Inc., 34 E. Putnam Ave., Greenwich, Conn.

▼ ▼ ▼

Manufacturing Must Have A Voice in Materials Specifications

By Joseph Gurski
Assistant Manager
Manufacturing Research
Ford Motor Co.
Dearborn, Mich.

Manufacturing must have all possible freedom in the selection of materials and processes as long as the end requirements of the product are met. Responsibility for achieving the most efficient utilization of materials lies in the two broad areas of product engineering and manufacturing. Product engineering is vitally concerned with adequate designs so that the part will do the required job. Manufacturing is concerned with the processing and the possibilities of standardization to reduce costs.

As result of the growing complications in parts, and the importance placed on processing cost with automation and complex machines, the problem of planning and timing assumes greater importance. For example at Ford, orders were placed for some parts for the '55 models as much as 23 months ahead of introduction.

Obviously, it is necessary to release designs considerably ahead of production deadlines. Further they must be correct in all respects and require little change or deviation during life of the model. It is for this reason that the selection of materials and processes must be such as to allow manufacturing departments all possible freedom. One cannot tell the manufacturer what is wanted in the finished item and tell him how to do the job too. If one insists on telling him how to do the job one must be ready to accept the results of that process. Obviously the best procedure is to specify the desired attributes and permit manufacturing latitude in materials and processing.

If one over specifies, then one pays for properties that yield no benefit as far end product is concerned. Improper specifications can result in unnecessary

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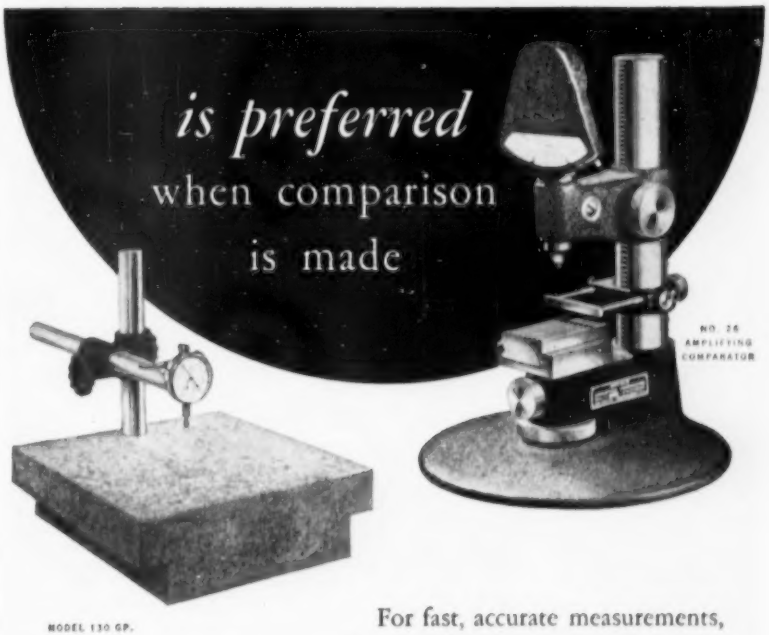
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payments of many thousands of dollars. For instance in the case involving a piston pin the original specification was revised from tubing to bar stock. By redoing the part processing the piston pin quality spec was removed. Magnetic testing was specified and the ordering size increased 0.010 inch. A slight calculated risk was taken that surface imperfections would be machined off and $50,400 was saved annually.

Materials Specs Cut Costs

The field of cost reduction is fertile. It is costly to pay for requirements which add nothing to the end product. Today more than ever before a manufacturer must be a dollar metallurgist.

In flat metals specifing a thickness by gage alone would be a constant source of confusion so that it has been necessary to specify decimal thickness in addition to gage number. Accordingly, when the American standard became available it was felt to be a desirable step to a adopt it. Many activities of the company have benefited from this simplification.

Efficient utilization of materials has many facets. Individuals responsible for effecting such programs must consider the whole picture in their efforts. Tendency in engineering is to operate in familiar areas and copy those specifications that have been in existence for some time. The tendency in manufacturing is to subordinate material savings if such materials require more attention be given to processing. In both cases, however, savings can be effected at little risk. Advantages of standardization and simplification are so obvious that there is no room for debate. While the execution of such a program is difficult, no company can afford to neglect this opportunity for savings.

From a paper presented at the 7th National Conference on Standards, American Standards Association, Inc., 70 East 45 Street, New York 17, N.Y., October, 1956.

▼ ▼ ▼

New Developments in Plastic Tooling

By J. W. Donnell

Professor of Chemical Engineering
Michigan State University
East Lansing, Mich.

Improvements are coming fast in plastic and tooling fields. Five of the most recent developments include a satisfactory resilient plastic die material, plastic mastic with a new method of application, high temperature plastic molds, plastic spray gun and plastic dispenser.

While resilient dies have been in use experimentally for a year or so, improvements have now eliminated many of the early disadvantages.

What are the chemical conditions resilient plastic dies must fulfill? First, the material must not exhibit cold flow. Second, the plastic shall not age harden. Third, excessive heat heads must not be exhibited during curing. Too high heat head will cause excessive shrinkage and, in some cases, cracks when applied to metal cores. Shock requirements must also be met. An important test is that of good adhesion. In many cases shock requirements demand change of hardness from 90-95 shore A to 30 to 40 shore.

Resilient dies have passed these tests and are now in actual use in industry. Most of the applications noted are from the aircraft industry. Where an excessively large number of parts are not required, this type of die makes an ideal tool since no allowance for metal thickness need be made. This permits a plastic casting for the female to be

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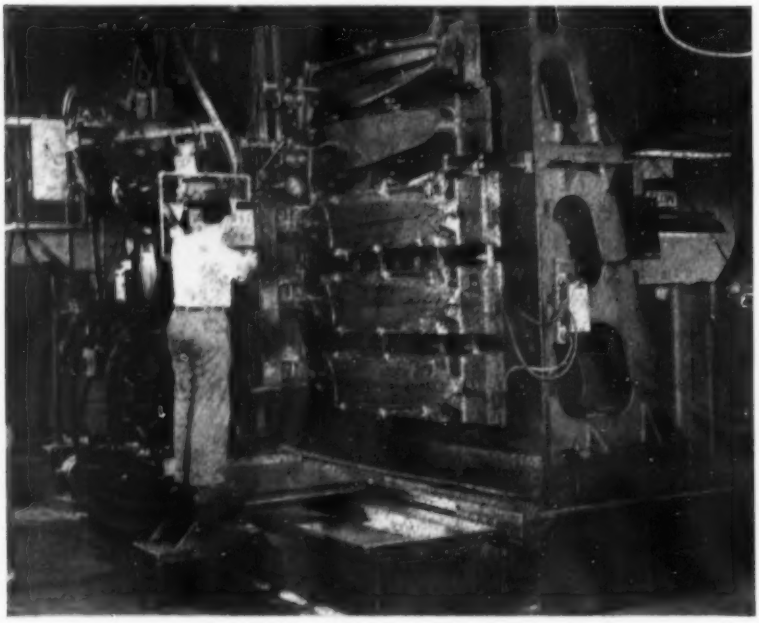

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made direct from the model and the male direct from the female.

Since many glass cloth resin parts are being used in both automotive and aircraft industries, demand has been heavy for heated stamping dies of plastic as an economy measure. Dies used for such plastic glass cloth parts as fender crowns or wing sections do not require heavy pressure but must be able to stand temperatures in the neighborhood of 300 F.

By including large amounts of metallic filler like granular aluminum, to the extent of twice that of resin content, some ten-fold increase in heat conductivity can be obtained. Several methods have been devised to apply heat by electrical asbestos or glass cloth tape imbedded in the plastic; by hot oil or steam coils in the mold; or by setting molds directly on hot platens. The third has proved most satisfactory.

Another development gaining considerable attention is that of a plasterlike epoxy hardener system that can be troweled on or between metal templates much in the fashion of ordinary wall plaster. Recently a spray gun mechanism has been developed to spray on such materials either for thin films or laminating processes. This involves many problems but has reached the stage of practicality.

As a companion piece to this spray apparatus, a dispensing unit is in process of completion that will allow withdrawal of any quantity of liquid mixed hardener and resin at the will of the operator. Final development stages of this mechanism are now being passed and the blender should be available shortly.

From a presentation at the University of Wisconsin, Tool Engineering Institute, September, 1956, Madison, Wis.

▼ ▼ ▼

Improving Welding Shop Management

By Joseph L. Fortunato
Alloy Fabricators
Perth Amboy, N. J.

With greater precision requirements, manufacturers have become increasingly aware of the necessity of maintaining close control of materials and workmanship. Production supervision must be kept abreast of changing methods and processes being developed to produce high quality welding. Procedures to secure this result in fabrication and welding should be established utilizing good shop management practice.

First a clear understanding of problems involved is necessary. This can be accomplished by production planning meetings with shop supervision. The meetings would discuss fabrication methods, welding procedures and interpretation of specifications and drawings.

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Proper identification of materials, including base metals and welding electrodes, is essential particularly in a welding shop where a variety of alloys are used. Qualification of welders, use of proper welding techniques and selection of equipment are all important factors contributing to quality results. Use of automatic welding equipment further reduces the margin of human error.

Liquid type penetrant examination, visual inspection, test plates, radiography, hydrostatic and mass spectrometer testing roundout basic procedures for maintaining proper control.

Standard procedures tie in all aspects of the welding operation from initial preparation to final assembly. Control of these various operations not only produce consistently high quality workmanship but also increase shop efficiency for repetitive operations.

From a paper given at the 1956 National Fall Meeting of the American Welding Society, 33 W. 39th St., N. Y. 18, N. Y.

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Appraising Simplified Drafting

By J. Gerardi

Assistant Dean
University of Detroit
College of Engineering
Detroit, Mich.

Simplified practices which have been proposed for industry use do not and cannot relieve the shortage of competent draftsmen. Different requirements in training engineering personnel may further complicate the present situation. If a product is in early stages of development and engineering offices and shops are close, simplified drafting can make a phenomenal contribution to the engineering effort.

Once a product has been through initial stages of design, drawings should be made according to American standard practices. The experience of many companies, which can be cited, indicates that attempts at oversimplification merely result in confusion and wasted effort. The best practices of simplification are being adopted by the various drafting and standardization groups of engineering societies.

Conflict with Engineering Education

Engineering education is changing rapidly, as a result of the impetus of science and research in industrial economy. Consequently, fewer and fewer engineering students and graduates are beginning their careers in the drafting room, thereby contributing to the shortage of draftsmen. Simplified drafting does not and cannot relieve this situation. Industry must assume the responsibility of training its own competent draftsmen. For its own sake, it must give draftsmen training which can be used regardless of his place of employment.

The conclusions are evident. Simplified drafting technique may be profitable if used locally, but cannot be tolerated where communication involves a large number of people or separated locations. The competent draftsmen has become a specialist whose knowledge is no longer limited to the delineation of drawing, but he is required to know technology which formerly was the sphere of engineers. Finally, most of the new concepts of simplification have not been adopted by industry or by authorized standardizing agencies.

From a presentation at the Drafting Institute of the University of Wisconsin, Madison, Wisconsin, November 9, 1956.

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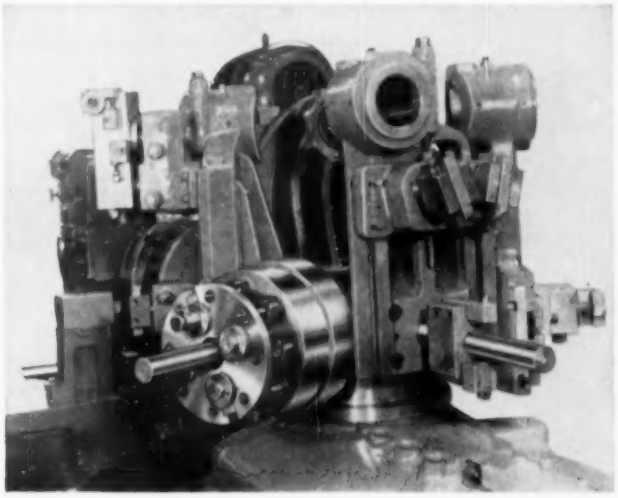

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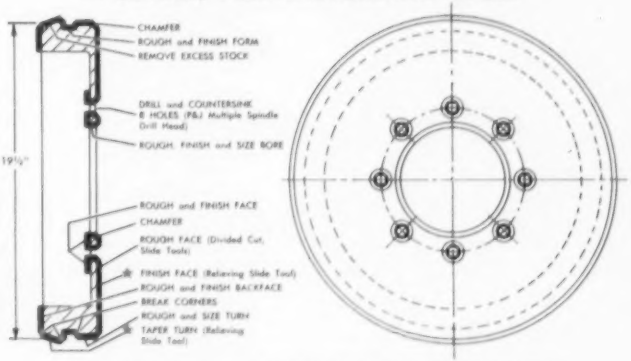

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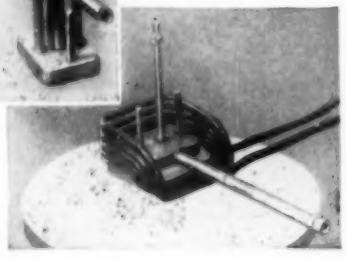

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tech digests

Contour Machining Requirements in Aircraft Production

By Charles Merlath
Industrial Engineer
North American Aviation, Inc.
Los Angeles, Calif.

Future tracer equipment should incorporate possibilities of integrating it with tape-control equipment. Also it is desirable to eliminate mechanical feedback for some applications and at the same time increase duplicating accuracy to conform with aircraft engineers' increasing demands.

For most pocket work in aircraft industries there are various rise-and-fall sections in the form of bosses for attach fittings. Therefore, electronic hydraulic tracer must be capable of operating on the pencil type principle.

One university is working on an electronic wave control stylus. This system should have capabilities of sensing changing motions before initially encountering them so the input signal could control the linear tracing rates proportioned to its tracing tolerance ability.

This system may have possibilities of meeting requirements for automatically tracing a complete pocket of a part, including rise-and-fall motions. The next forward step will be development of a package tape-control system to perform the functions of cams, templates or patterns. The particular requirements of this unit would be that the tape must be able to program the machine to eject its previously used cutter into a cutter file mounted on the machine, and select a new cutter from the file for its next operation. The machine should automatically adjust its depth motion to correspond to the new cutter, in relation to its required depth in the work. This adjustment can be located from the work-holding fixture. The machine should automatically adjust planer movements to correspond to the new cutter diameter in relation to internal or external periphery operation. This setting can be readjusted from location points on the work-holding fixture.

From a paper given at the 1956 Contour Machining Conference, sponsored by Tru-Trace Corp., Los Angeles, Calif.

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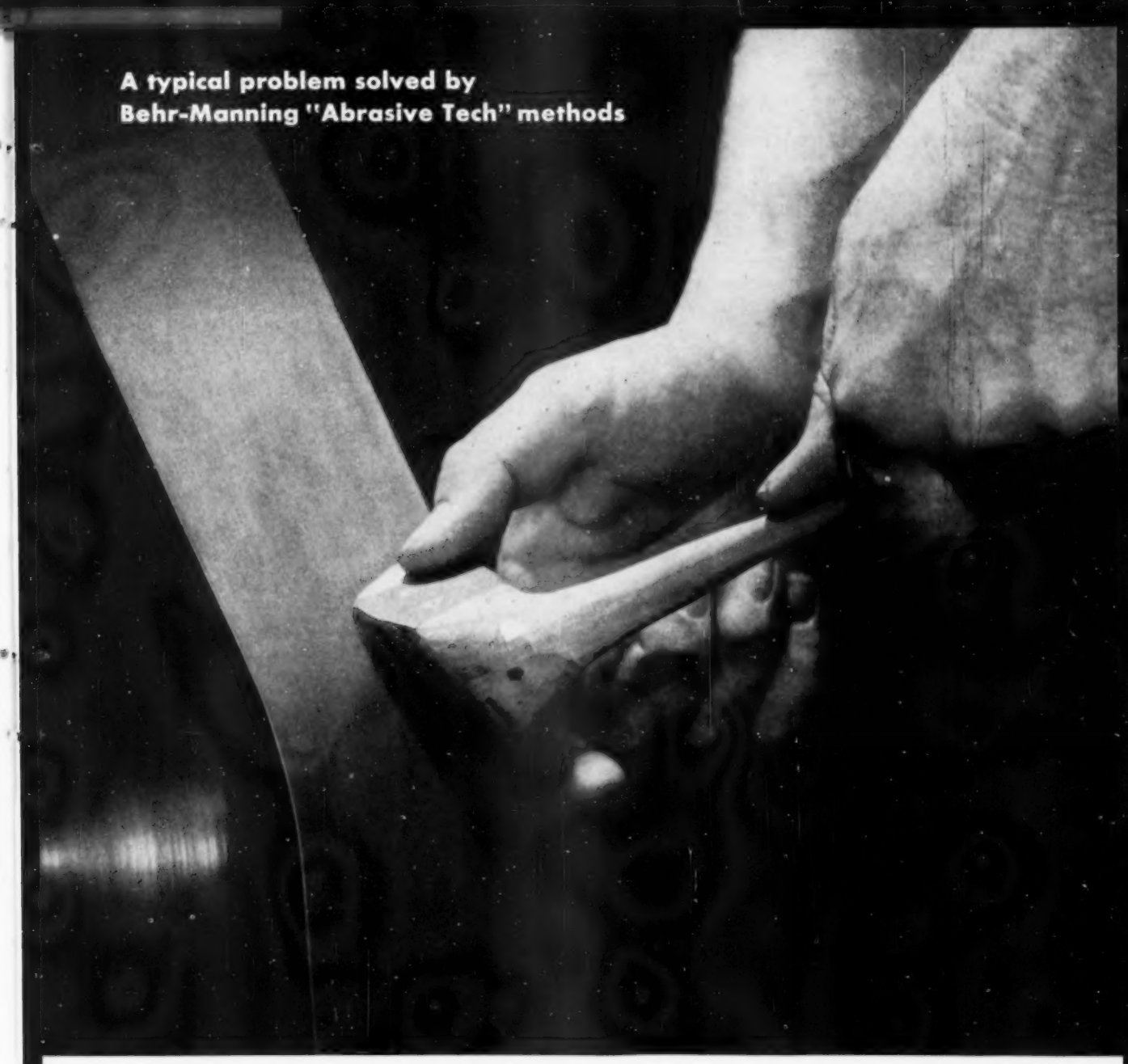

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Complete hydraulic service... from one dependable source...

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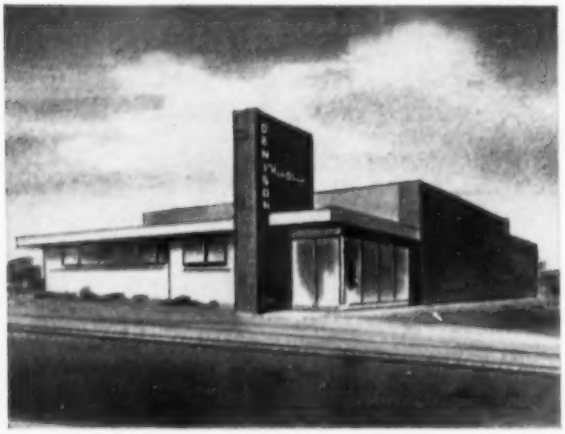
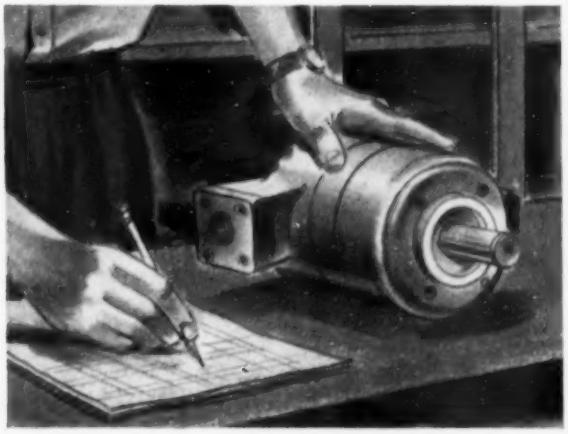
FREE APPLICATION ENGINEERING by experienced hydraulics specialists to improve your circuits.

JOB DEMONSTRATIONS to *prove* how your operations can be made more efficient with the new hydraulic developments.



REGIONAL FACTORY SERVICE includes *complete maintenance facilities* for building, testing, repairing equipment.



OVER-THE-COUNTER SALES from local stock to give you *immediate delivery* of hydraulic pumps, motors and controls.

Behind the name Denison... With its regional warehouses and branch offices, Denison's factory service is now as near as your telephone. Specialists in hydraulics are immediately available to help you build a better product, build it for lower cost.

Regional Warehouses in Chicago, Houston, Los Angeles, Clark, New Jersey. Branches in every principal city.

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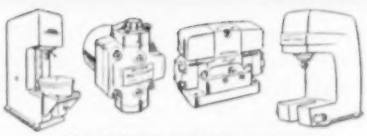

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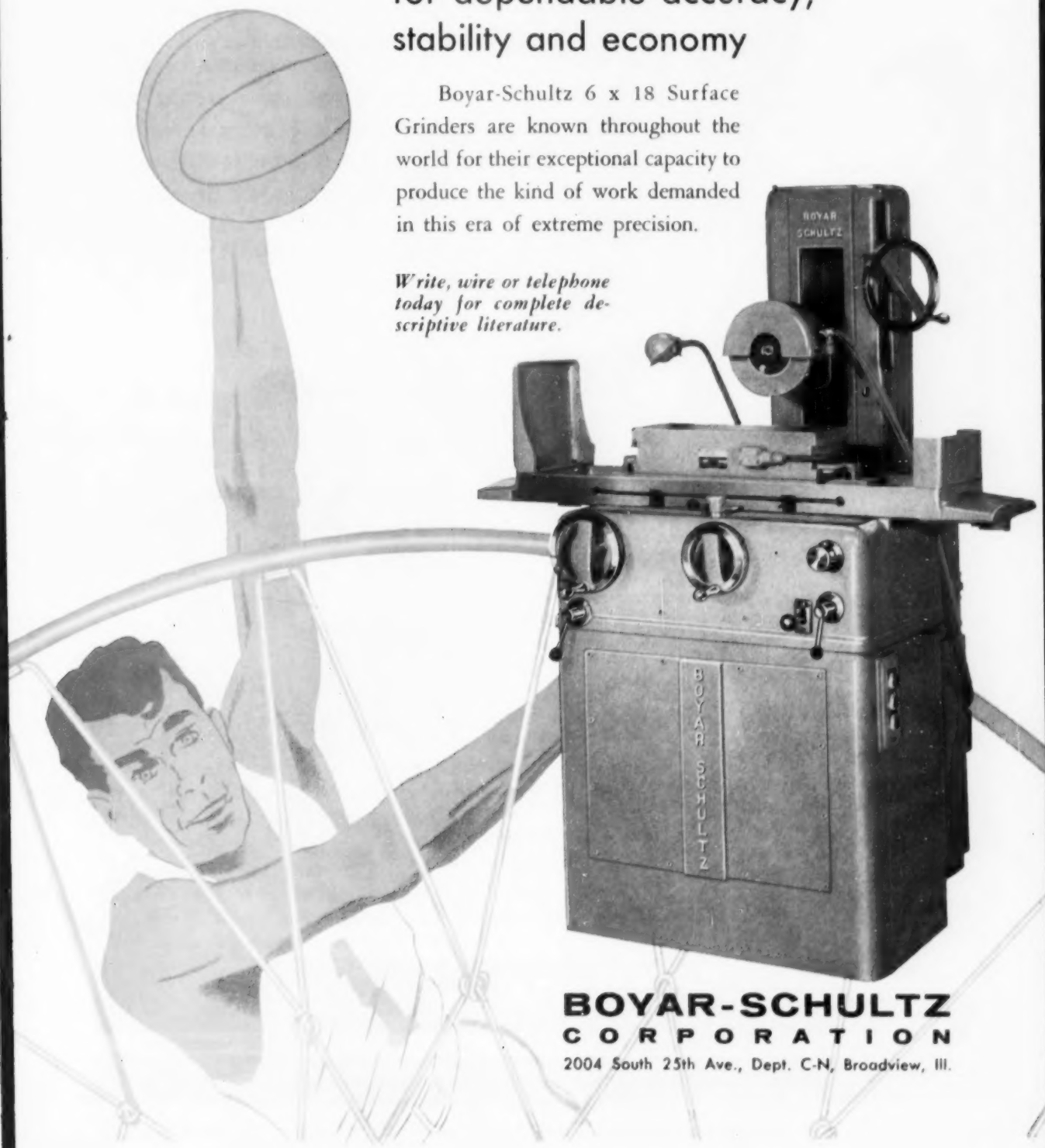
always
A JUMP AHEAD

for dependable accuracy, stability and economy

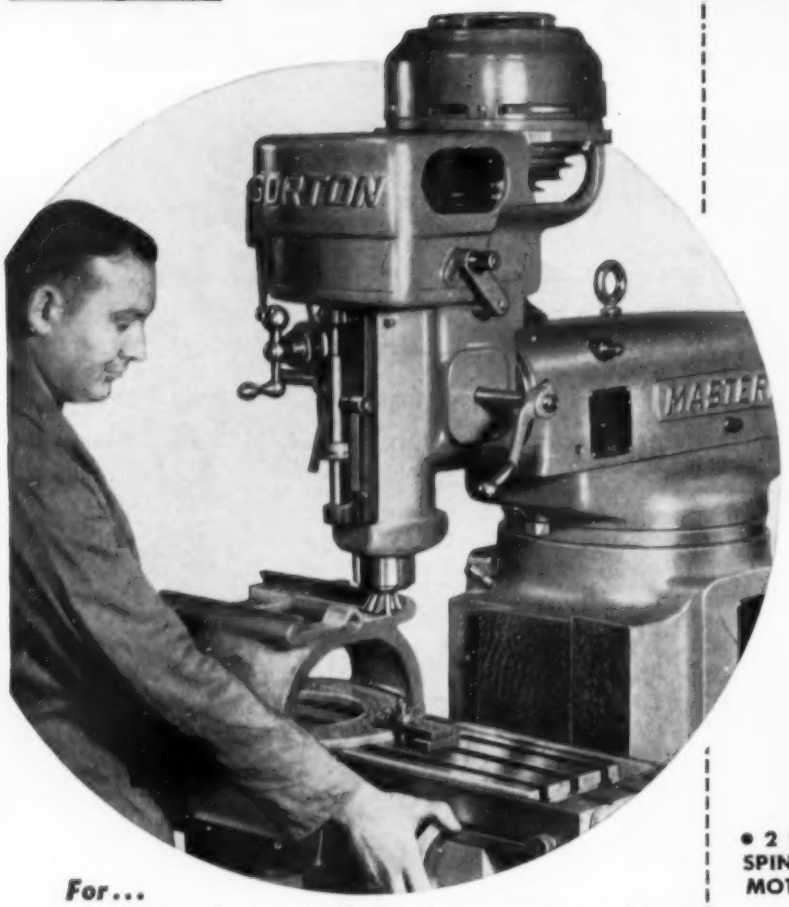
Boyar-Schultz 6 x 18 Surface Grinders are known throughout the world for their exceptional capacity to produce the kind of work demanded in this era of extreme precision.

Write, wire or telephone today for complete descriptive literature.

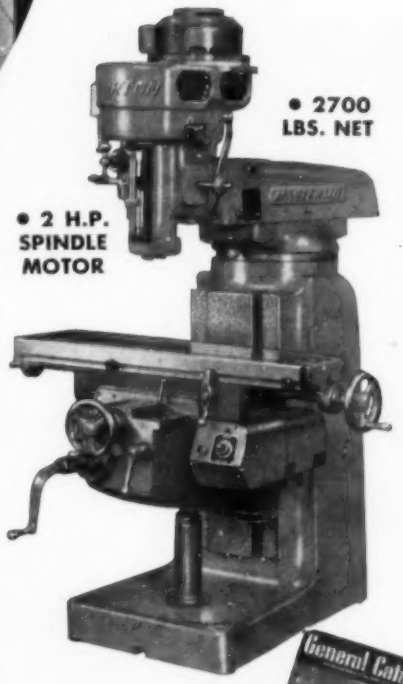


BOYAR-SCHULTZ
CORPORATION
2004 South 25th Ave., Dept. C-N, Broadview, Ill.

NEW Gorton Mastermil



- PRECISION SPINDLE; 10 SPEEDS, 80-5600 R.P.M. *STANDARD*
- DESIGNED AND BUILT TO PROVIDE SUSTAINED ACCURACY
- LONGITUDINAL FEED, 22 INCHES
- SADDLE LENGTH, 24 INCHES
- CROSS FEED, 10½ INCHES
- VERTICAL FEED OF KNEE, 15¼ INCHES
- SPINDLE FEED, 4 INCHES



- 2700 LBS. NET
- 2 H.P. SPINDLE MOTOR

For...

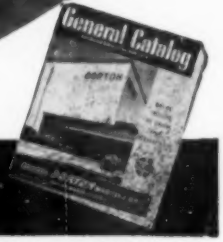
Milling, boring, duplicating in tool rooms, model shops, pattern shops, production lines, general machine shops, experimental laboratories, machine shops, schools — wherever high-speed vertical milling is done.

Also available...

Infinitely variable spindle feed from ¼ inch to 8 inches per minute.

Infinitely variable table feed (longitudinal) in 4 ranges: from ½ inch to 60 inches per minute.

Ask for special bulletin, No. 2699, on new Gorton Mastermil and for general catalog, 2602-1655, covering the entire Gorton line.



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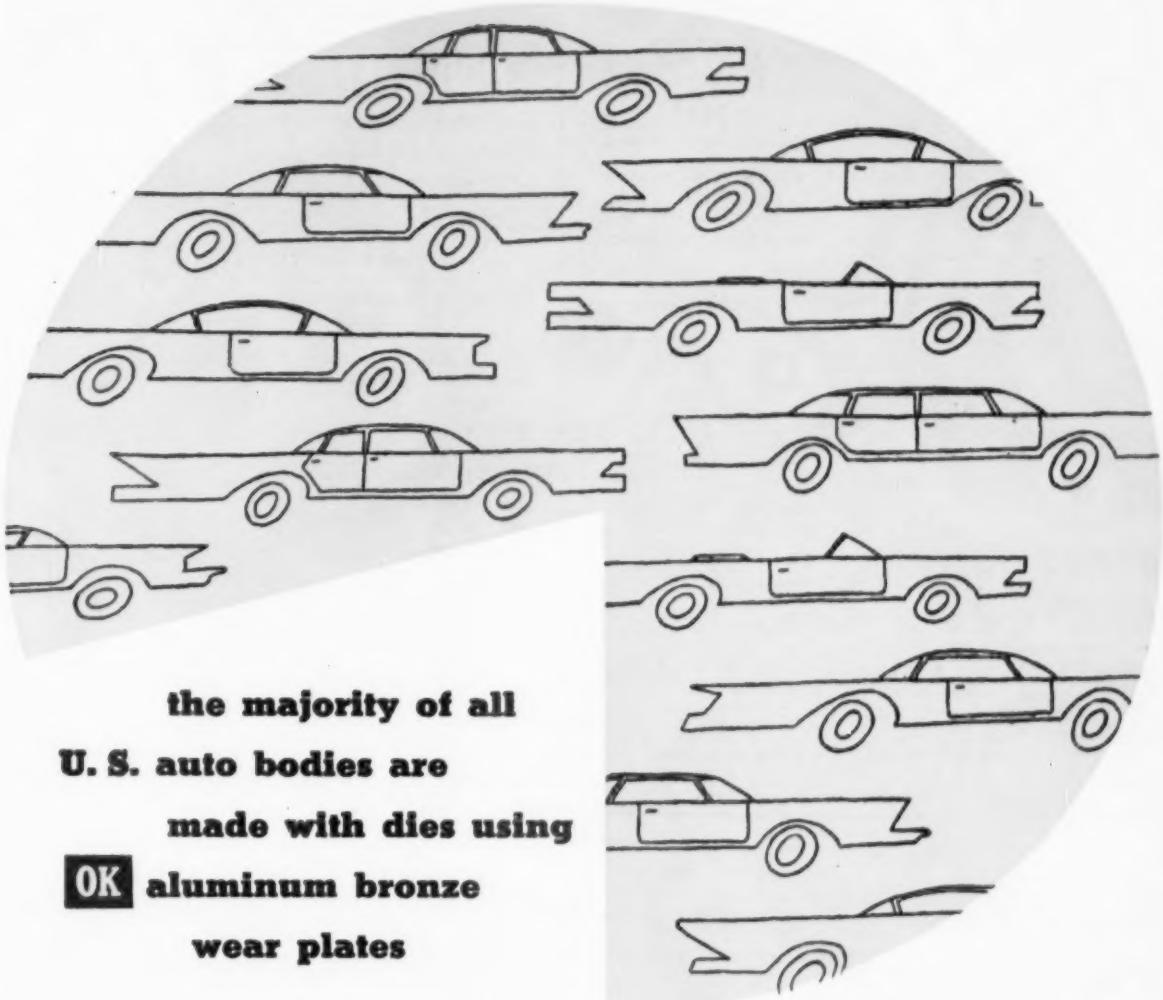
GEORGE GORTON MACHINE CO.

2602 RACINE ST. RACINE, WISCONSIN

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A 8752-1P



the majority of all U. S. auto bodies are made with dies using OK aluminum bronze wear plates

Here's why: You can save approximately 40% under the cost of expensive solid bronze wear plates . . . and you receive completely finished wear plates, available from stock, ground to ± .0005 parallel and flat. By a unique cladding process, long wearing aluminum bronze is bonded to a steel base, easily machinable for fitting to dies. Drilling or counterboring can be done through bronze surface if required. Wherever your die has a sliding or cam action, OK aluminum bronze wear plates, because of their great wearing qualities, assure longer die life.

Photo at right shows OK aluminum bronze wear plates in a body die at one of the world's largest automotive plants. Complete information is in our new OK Catalog. For your free copy, write Dept. 55-U.

THE OHIO KNIFE CO.
CINCINNATI 23, OHIO

SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES • SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

*$18.50 is the list price for the ¼" port size and $19.50 for the ⅜" less usual quantity discounts.

250 P.S.I.

4-WAY VALVES

for Air and Cost-Minded

TOOLING and PRODUCTION MEN

Important Savings	Low initial cost. Need no oilers and filters (time and materials savings).	All components are corrosion resistant.
Low Maintenance	Sealing qualities do not diminish with long, continued use.	Wear compensating "Shear-Seal" design.
Long Service Life	No production delays. Maintenance (rarely needed), without disturbing plumbing.	Lapped metal to metal sealing members.
Not Critical to Dirt	No scoring or binding. (As with spool or popper designs.)	Flow is through "Shear-Seals." Sealing surfaces remain in constant intimate contact.
No Creeping Cylinders	Leakproof closure. (No internal port to port leakage.)	Maintained through lapping action of each operation.

Ask for bulletin A-5.

Foot operated models with or without spring return to reverse or to center are $24.50 list for the ¼" and $25.50 for the ⅜" valve less quantity discounts.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

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new SCHERR

TOOLMAKERS MICROSCOPE

WITH INTERCHANGEABLE DIAL TEMPLETS AND OCULARS

Reading Angles in Minutes
Thread Templets for U. S. National Thread Profiles-6-80 Pitch. Radii Templets, etc.
LARGE MICROMETER DRUMS READ DIRECTLY IN .0001"
Measuring Range 2" x 1-1/2" and other sizes
A moderately priced PRECISION MEASURING TOOL for Toolroom and Inspection

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COMPLETE LINE OF PRECISION INSTRUMENTS

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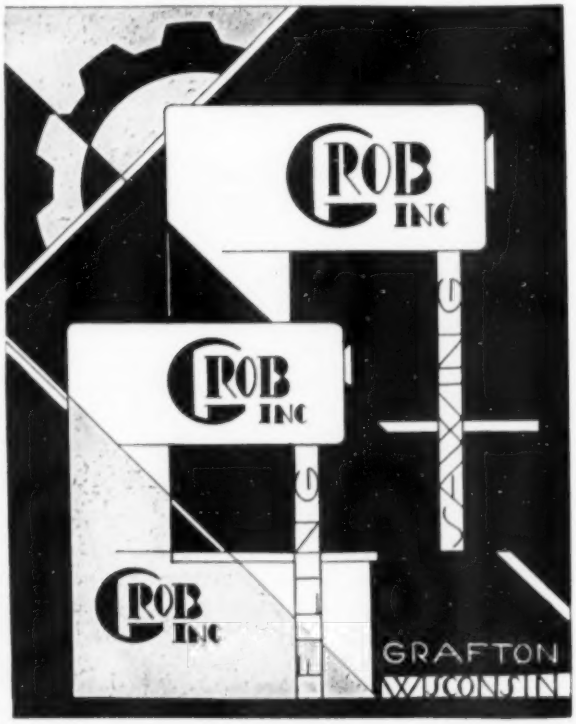


USE READER SERVICE CARD: INDICATE A-2-232-3

*Controlled Measure

Just as the basic plans for a de-luxe shopping center or a super highway depends on surveyor's instruments for "controlled measure"

so does the precision of many important components depend on BATH GAGES for the "controlled measure" and smooth performance of the finished product.

When it comes to checking close tolerances in threaded and plain parts and holes — you can rely on Bath cylindrical plug or thread, ring and reversible gages for dependable inspection and long wear-life.

When you buy Bath Gages
*... you buy *"controlled measure".*

JOHN BATH & CO., Inc.
28 Grafton St., Worcester, Mass.
CYLINDRICAL AND THREAD GAGES · GROUND THREAD TAPS · INTERNAL MICROMETERS

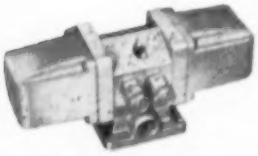
FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A 2-233

LOOK TO BECKETT
for ADVANCED DESIGN.

HI-CYCLIC

AIR and HYDRAULIC DIRECTIONAL CONTROL VALVES

A COMPLETE LINE—Solenoid, manifold, piloted, solenoid piloted, lever, cam roller, spring center, detent and combinations of these actuators are available for immediate delivery. All spool characteristics: 2 position, 3 position, float piston, open center, closed center, servo type, port exhausting center position—all carried in stock.



DIRECT SOLENOID-OPERATED VALVES
Available in ⅛" to ½" pipe ports. Built-in junction box; heavy-duty, industrial-type solenoids; moisture-tight covers.

SOLENOID VALVE-PILOTED MODELS
Fast operating — inexpensive. Available for practically every voltage, current, cycle and ambient condition. All sizes furnished for ⅛" to 1" pipe ports for air and gas service only.

MANIFOLD VALVES (GASKET MOUNTED)
All Hi-Cyclic Valve models—all actuators, all spool types—available with gasket-mounting for sub-base piping. Designed for absolute minimum down-time for parts replacement.

MECHANICAL AND HAND-OPERATED VALVES
Lever, cam roller, piloted and fingertip valves. All actuators interchangeable and valves can be equipped with combinations of these actuators—as a cam valve may be pilot returned; or hand-lever valve may be cam roller returned, etc. Furnished from ⅛" to 1" pipe ports except fingertip valve, which is available to ½" pipe ports only.

Write for complete valve catalog or detailed information on Hi-Cyclic Valves to meet your job requirements.

DISTRIBUTORS IN MAJOR CITIES COAST-TO-COAST

THE BECKETT-HARCUM COMPANY

1097 WAYNE ROAD, WILMINGTON, OHIO

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For MORE PERFECT TAPPING AND REAMING

To attain the high degree of perfection necessary to insure the elimination of spoilage losses caused by imperfect set-ups in tapping and reaming is not a difficult matter if you use Ziegler Tool Holders.

This is because, with the Ziegler, inaccuracies in set-ups are automatically corrected—even though they amount to as much as 1/32" on the radius or 1/16" on the diameter.

Equip your machines with Ziegler Holders and see for yourself how they will help you avoid oversize and bell-mouthed holes.

PROMPT DELIVERY

W. M. ZIEGLER TOOL COMPANY

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Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

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Look into the complete, cost-cutting* LOVEJOY *line. Standard tools are in stock – to help you increase production, save time and money now!

INSERTED-TOOTH MILLING CUTTERS
Face, side, end, slotting and boring mills.

H. S. S., CARBIDE, ALLOY BLADES
Interchangeable in all Type "A" milling cutters from 4½" to 24" in diameter.

NEW! SET-SCREW TYPE END MILLS
And new Type "Z" slotting cutters provide maximum axial and radial adjustment.

Boring Tools • Arbors • Flywheels
Lovejoy Milling Cutter • Assembly Gage

Special cutters are a Lovejoy specialty
Write for new catalogs: No. 31 (Face Mills), No. 32 (Side Mills), No. 33 (Arbors).

131 MAIN ST., SPRINGFIELD, VERMONT

Send for free **SPEED & FEED CALCULATOR**

LOVEJOY TOOL COMPANY, INC. Ltc
SPRINGFIELD, VERMONT, U.S.A.

USE READER SERVICE CARD; INDICATE A-2-234-3

The ONLY Turret Lathe with a fully automatic thread-chasing cycle!

Here is full turret lathe versatility and a threading attachment with a fully automatic cycle — all in one machine. Now you can be sure of concentricity of threading with other lathe work, *all done in one chucking*, with the time saving of the Auto-Threader! Nowhere else in the world can this be found on a turret lathe.

This Auto-Threader will chase straight or taper threads — or a combination — internal or external, from the front of the machine.

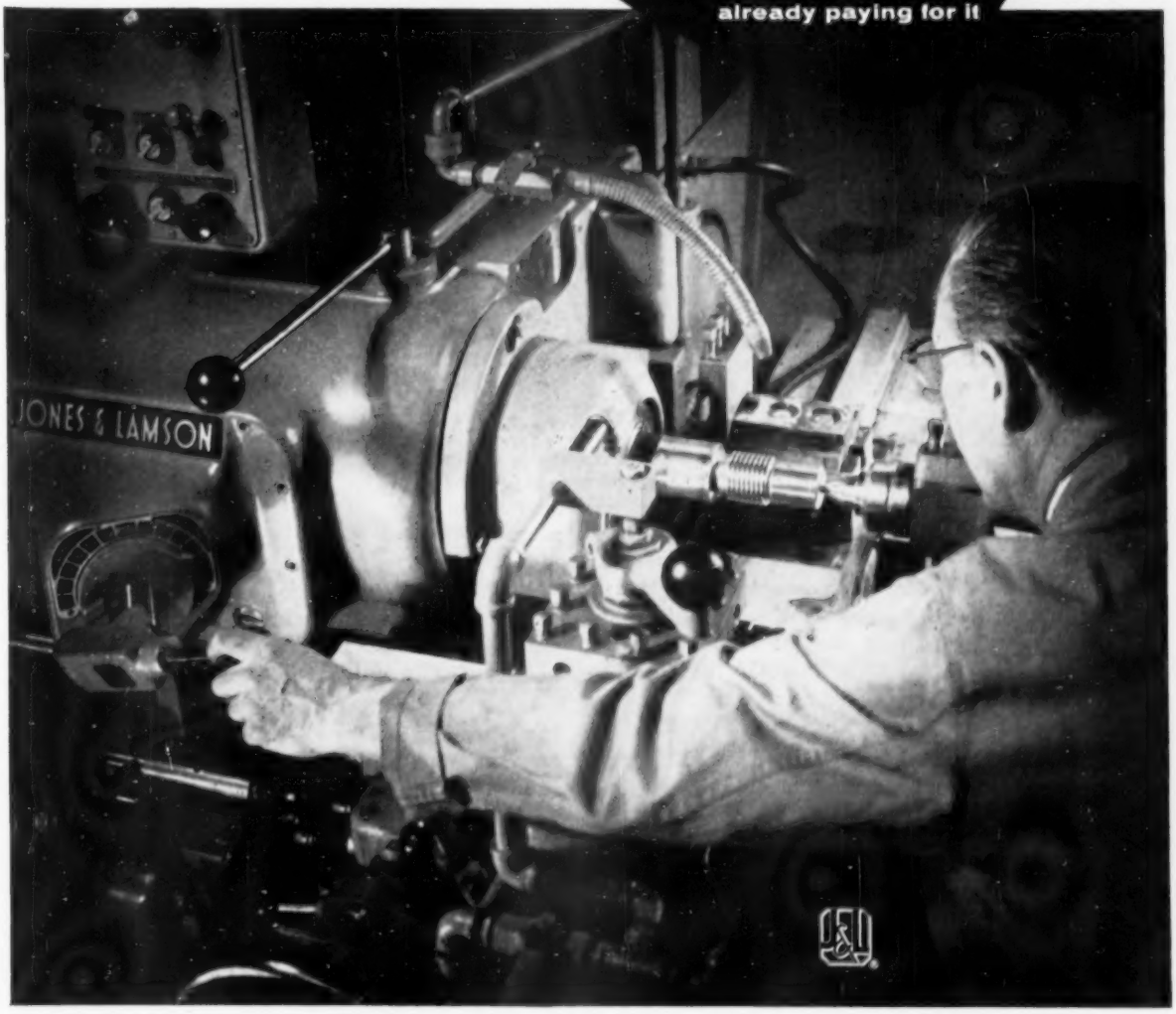
Concerning this J&L development, a customer writes: "We are tripling production on many of our items."

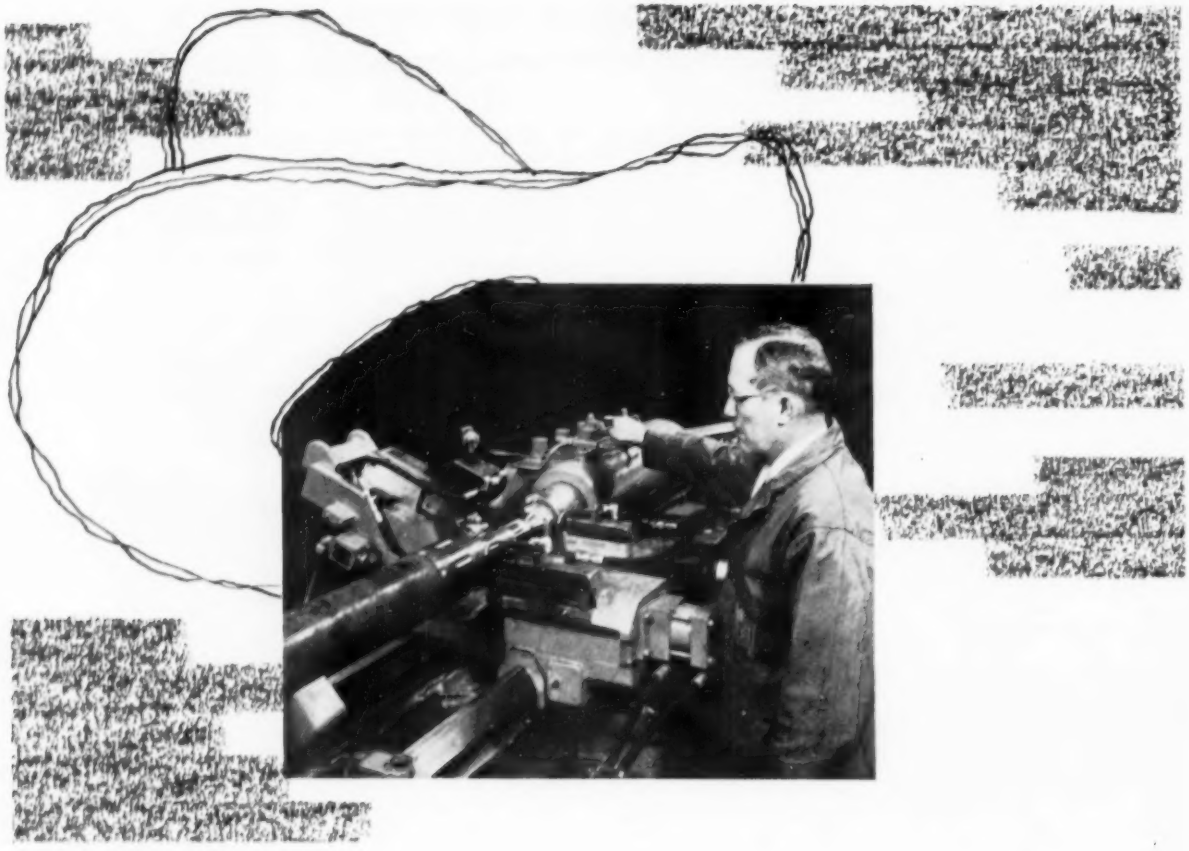
Write for descriptive folder No. 5440. JONES & LAMSON MACHINE COMPANY, 518 Clinton Street, Springfield, Vermont.

JONES & LAMSON TURRET LATHES

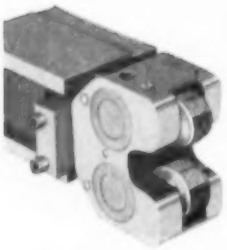
the man who needs a new machine tool is already paying for it

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools Thread & Form Grinders





Roll your own *in no time* with a Monarch Mona-Matic!



ON THIS JOB, thread rollers mounted on the hydraulically-operated rear slide perform a very precise thread rolling job *during traverse return* of the front carriage. If that's not strictly "no time," it's certainly "no-cost time"—and who could possibly want more than that?

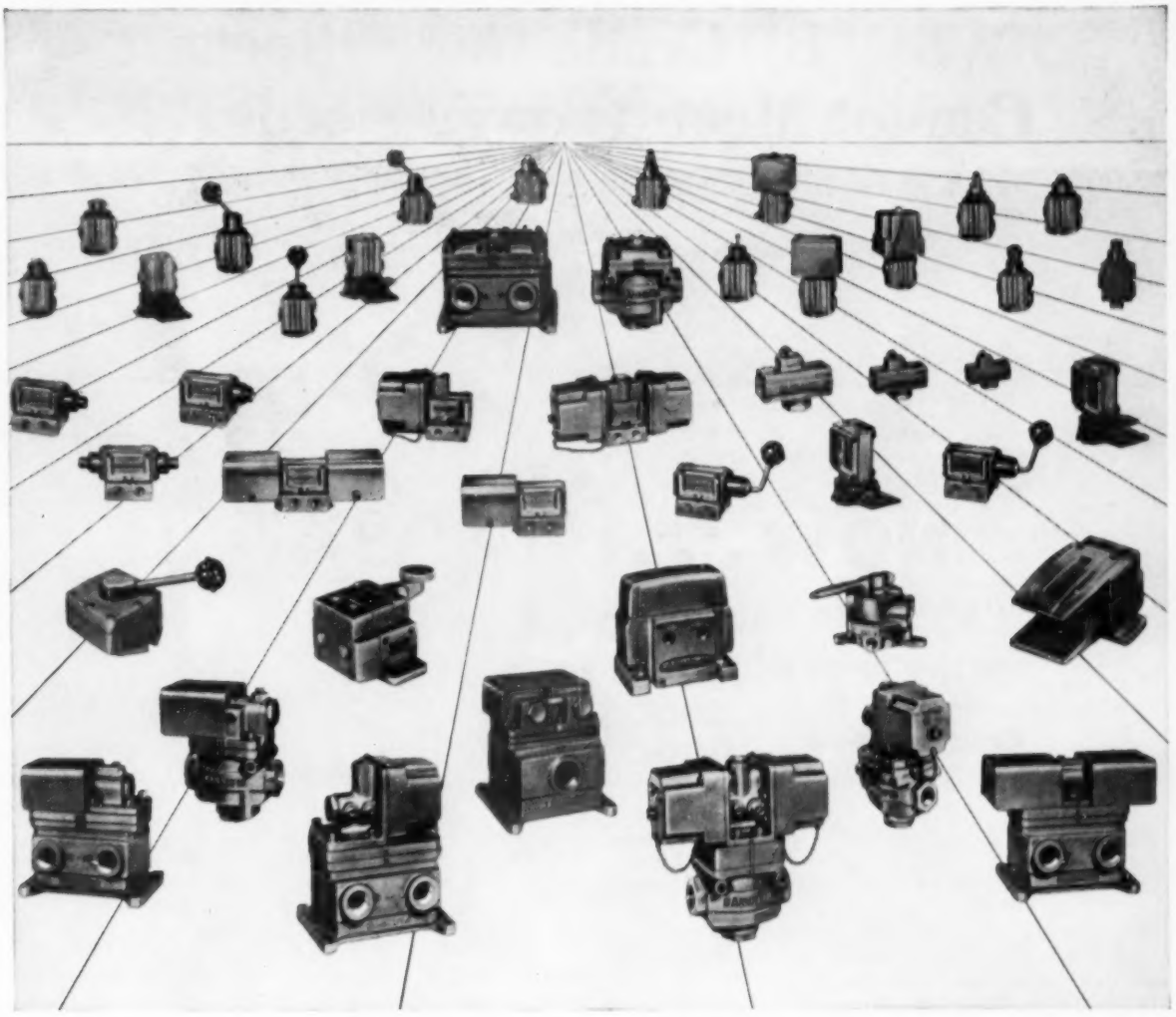
The part is a fabricated trailer axle, about 80" long, identical spindle ends of which are turned and threaded. There are three turned sections on each end with the end diameter threaded at the tag end of the cycle.

Because the axle is fabricated by butt welding the forged, rough turned spindle ends to a piece of seamless steel tubing, an interesting front carriage cycle is employed. During one of the three feed movements, the welding bead is removed by a tool on a hydraulically operated auxiliary slide mounted on the left hand end of the carriage.

And that's only part of the Mona-Matic savings story! Customer used to turn on one machine, thread on another with a die head. Now he does the *whole job—on one machine—faster than just the turning used to take.*

Remember that thread rolling (up to 1½" diameter) is an extra for some users—only one of many that can be yours when you turn the Mona-Matic way. Let us figure a job for you...**The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch
TURNING MACHINES
FOR A GOOD TURN FASTER . . . TURN TO MONARCH



These valves like tough jobs

Discriminating engineers are finding that out. More and more of them are specifying Hannifin valves for every kind of directional air control—including the really tough jobs.

There are plenty of reasons why: Inspired simplicity of design. Fewer parts—and *those* easily and quickly replaceable. Ability to serve a wide range of applications with fewer valve models. And—above all—fast, smooth operation.

Your Hannifin man will gladly give you the whole story. We'll tell you where to get in touch with him—after you examine the big Hannifin catalog.

AIR CONTROL

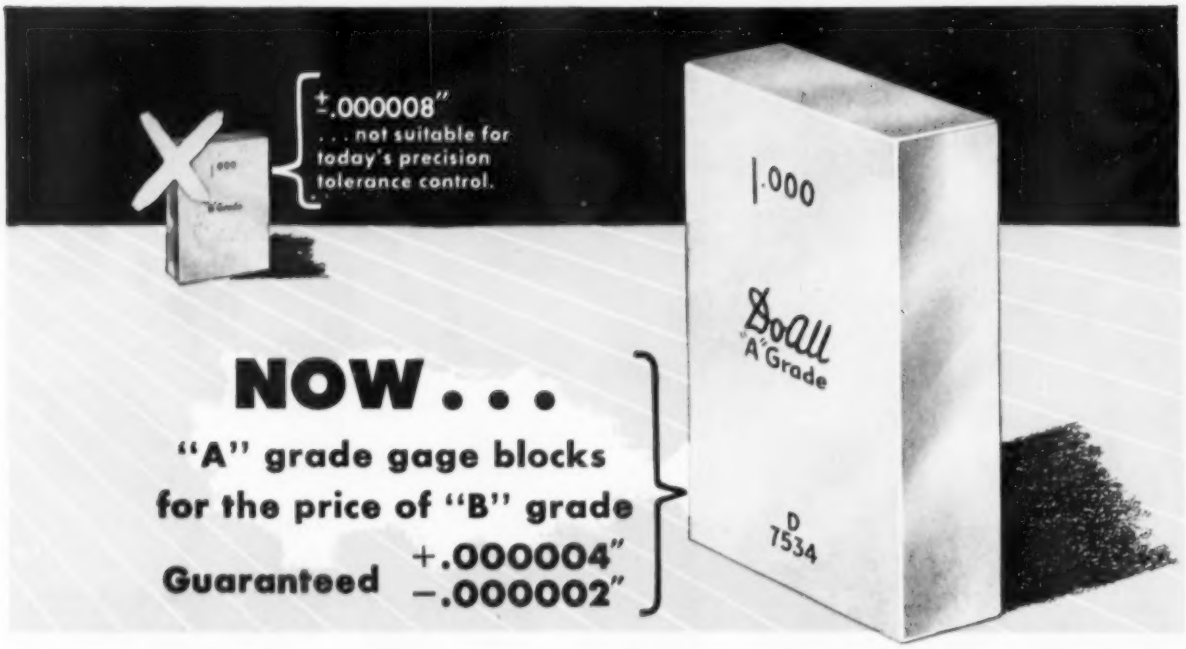
HANNIFIN

VALVES

For this complete catalog **showing all the Hannifin directional air control valves, write to Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois.**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-237

Why "B" Grade Gage Blocks Cannot Meet Today's Needs...



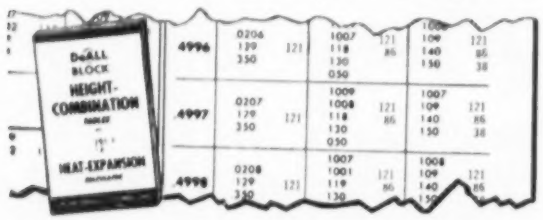
NOW . . .

"A" grade gage blocks for the price of "B" grade

Guaranteed +.000004" −.000002"

Here is Why: Consider .0001", a common part tolerance today. The checking gage must be accurate to .000010"—equal to or better than the accuracy of many gage blocks in common use! For example, a new one-inch gage block is acceptable as grade "B" if accurate to ± .000011", including observational errors. A single two-inch block could have a permissible error of ± .000020", amounting to 20% of the .0001" tolerance.

Such inaccuracies may be greatly multiplied when a stack of blocks is used. For example, in checking a shaft



dimension of 2.4977 (± .0001") a minimum of five blocks from an 86 piece set would be required. Assuming the most favorable combination—one two-inch block and four others—the stack *could* vary plus or minus .000064" (over a half-tenth). This is more than half the allowable tolerance of the part itself! If some of the individual blocks were plus and some minus, the total error would be less—but how much less?

When dealing with critical tolerances, "B" grade blocks just aren't adequate. Contrast them with DoALL "A" Grade Blocks *now available for the price of "B" Grade.*

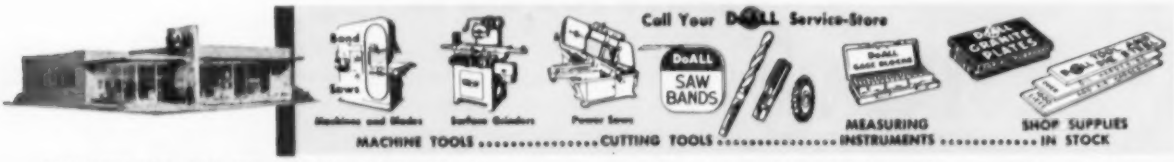
New DoALL "A" grade standards are plus .000004", minus .000002" maximum error per inch of length. Surface finish is guaranteed 0 to 0.09 RMS microinches, permitting calibration to within tenths of a millionth of exact size. Here is working accuracy you can rely upon —accuracy that eliminates need for calculating calibrated sizes, prevents errors, saves time and money. Why have less? Get the facts about DoALL's new gage block standards that meet today's needs. Remember, DoALL offers "A" Grade Gage Blocks at "B" grade prices.

Ask for Catalog—Call your local DoALL Store, or write

THE DoALL COMPANY

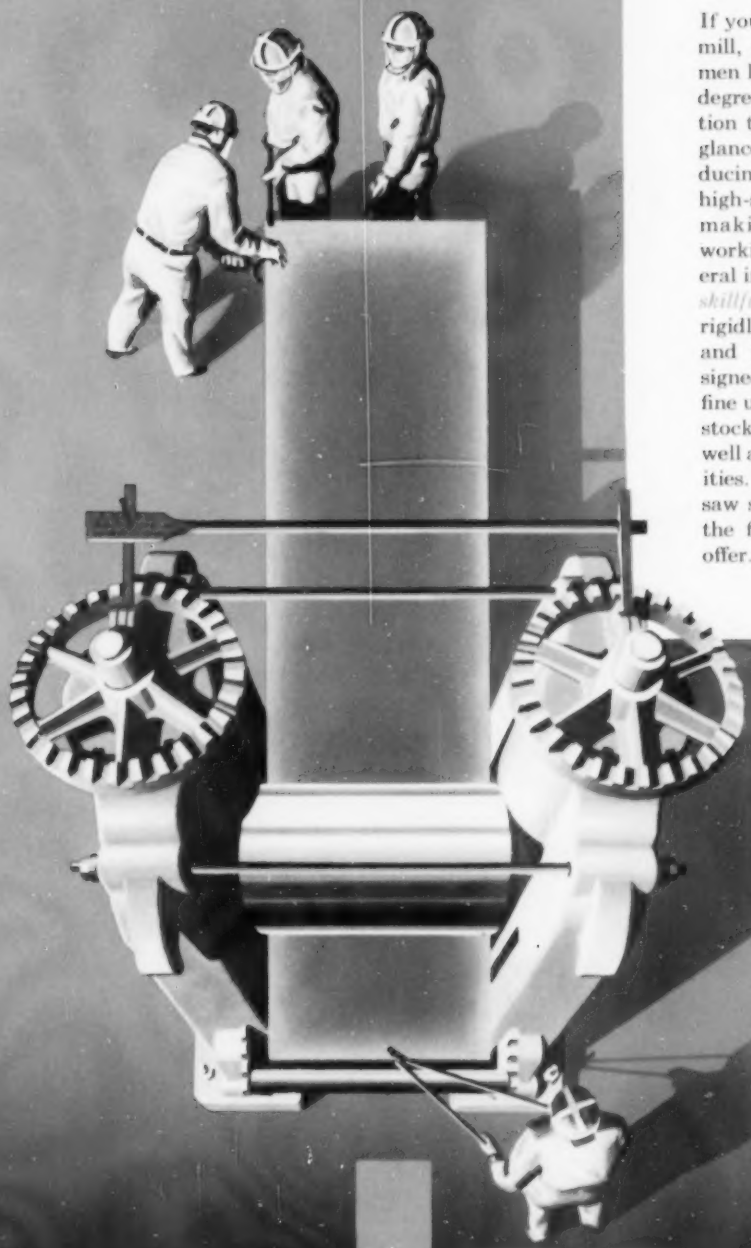
Des Plaines, Illinois

FREE — "How To Be Your Own Bureau of Standards" — tells how to inspect and calibrate gage blocks in your own shop. The only manual of its kind. Your copy free on request.



FRIENDLY DoALL STORES IN 38 CITIES give you personalized service and local delivery from complete stocks

How Jessop skill makes better saw steel



If you could peer down into the Jessop mill, chances are you'd see groups of men hand-rolling sheets of steel with a degree of skill and careful concentration that might seem excessive at first glance. *Yet it isn't.* These men are producing a very special steel—top quality high-speed sheet which is used in the making of hack-saw blades, woodworking tools, metal-slitting saws, general industrial knives, and the like. But *skillful finish rolling isn't all.* Jessop rigidly controls its melting formulas and pours small ingots specially designed for cross rolling. This insures a fine uniform grain structure so that the stock blanks well, forms well, swages well and has superior edge holding qualities. Remember, when you order your saw steel from Jessop, you are buying the finest that Jessop experience can offer. *And that's mighty fine steel.*

JESSOP

STEEL COMPANY · WASHINGTON, PENNSYLVANIA

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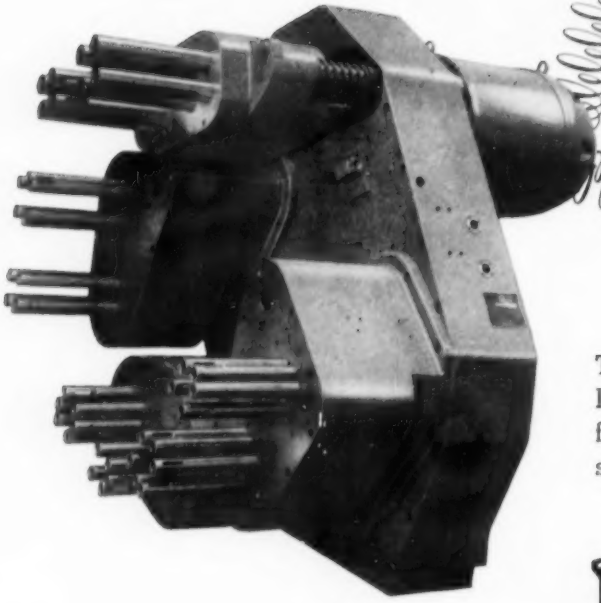
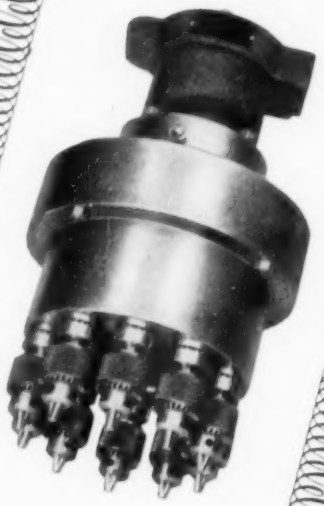
FROM THEN...
...TO ETERNITY





1924

The U. S. Drill Head Company's first Fixed Center Drill Head was produced for Borg and Beck, of Chicago — a subsidiary of Borg-Warner.

1957

The 50,000th Head was shipped.

For men who know drill heads best, it's always U. S. Drill Head ...5 to 1

Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD

THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

new

electro-ground

carbide end mills

manufactured by **ELGIN**

Elgin GOLDEN CIRCLE Carbide End Mills . . . solid carbide, of course, for the toughest jobs. But most important, Elgin Golden Circle End Mills are ground by Elgin's new Electro-Grind process which completely eliminates the strains and grinding checks caused by conventional methods. No chance for chipped or flaked cutting edges caused by high temperatures during grinding!

Electro-Grind combined with the use of extra fine grit wheels gives the sharpest, smoothest cutting edges yet—your assurance of the highest quality tools obtainable, increased production, less frequent regrinding, greater accuracy.

Write for new catalog showing complete line of solid carbide end mills, drills, reamers and burs—in stock for immediate delivery.

Abrasives Division

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS

dixi 60

horizontal optical jig borer

with 5 optical microscopes

DESIGNED AND BUILT FOR:

VERSATILITY
Optical settings for operations in all planes and compound angles . . . Equally suitable for tooling, short-run or production work . . .

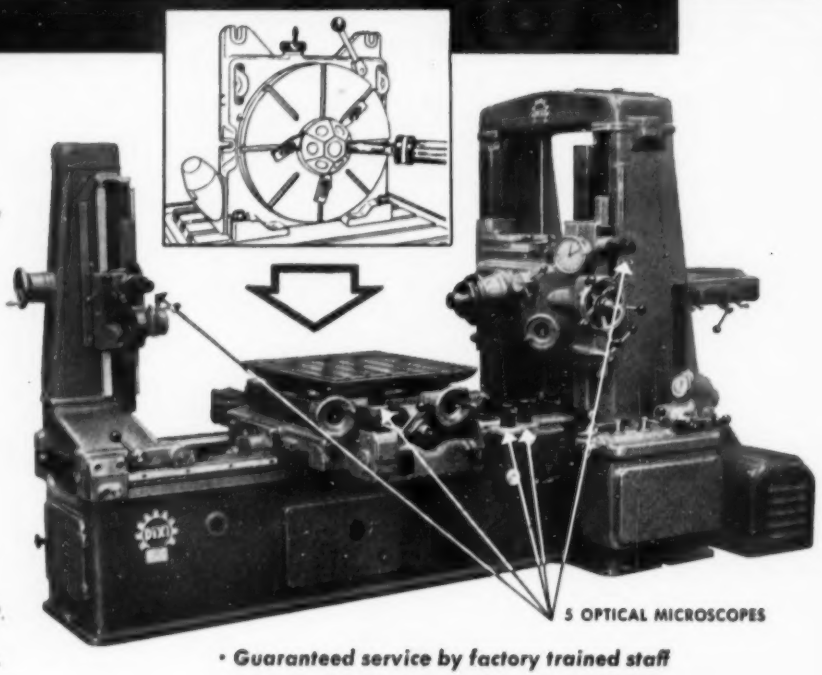
ACCURACY
Overall accuracy of .0002"

A precision machine for *JIGLESS* boring, facing, milling, and drilling work, in all planes. Built-in 360° optical rotary table, 28¾" x 32⅝". All spindle and table settings by optical microscopes. Infinitely variable hydraulic feeds. Mechanical spindle feeds with automatic depth stop. #40 taper spindle-speeds infinitely variable to 1400 R.P.M. Special features eliminate effect of spindle overhang on accuracy.

DIXI 450 PRECISION OPTICAL CIRCULAR DIVIDING TABLE

Direct readings of 1 sec.

(See insert picture above) rigidly mounted (not tilting) on built-in rotary table permits holding close tolerance relations between bores in all planes, including bores at compound angles. ALL IN ONE SET-UP. All sides of the work piece except the mounting face machined in one set-up.



- ***Guaranteed service by factory trained staff***
- ***Engineering staff available for consultation***
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- ***Your operators trained***

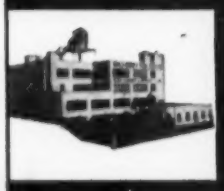
DIXI 60 now in wide use in leading Aircraft and Manufacturing Plants throughout the United States.

Names available upon request.

SEE THIS VERSATILE MACHINE IN OPERATION

at our New York or Cleveland Show Rooms. Write for Complete descriptive literature and prices to Department 21. Catalogues on additional production equipment also available on request.

MBI



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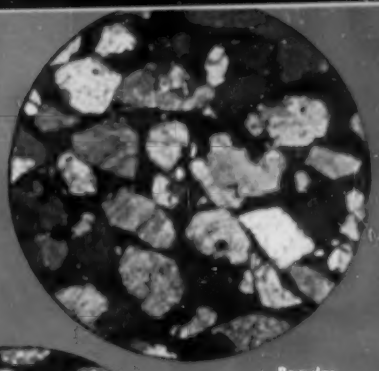
NEW in toughness

NEW in cutting action

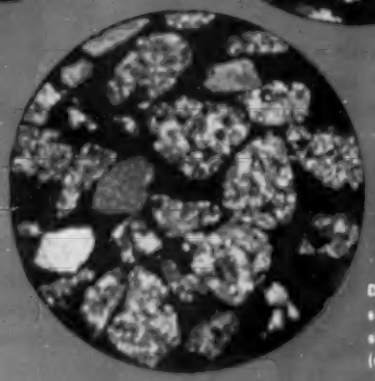
NEW in grinding economy

NEW LIFE

for more grinding . . .



Regular Aluminum Oxide (unretouched)



DA Borolon smaller crystal structure (unretouched)

NEW

SIMONDS ABRASIVE CO.

DA Borolon®

TRADE MARK

for resinoid bonded snagging wheels

A big forward step to new efficiency in grinding steel mill billets and foundry castings. Note the smaller crystalline structure of DA Borolon within each abrasive cutting particle! This means inherent toughness to resist fracture during grinding stress . . . more and sharper cutting edges on the wheel face . . . longer, useful wheel life . . . and more production per wheel dollar. Test after test on swing frames, floor stands and portables prove that Simonds wheels with this new aluminum oxide abrasive belong on your grinders for more production at lower cost. Write for descriptive bulletin.

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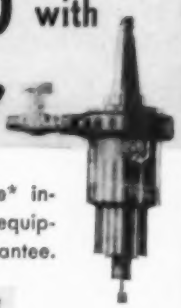
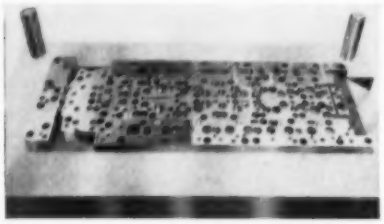
Holes

JIG GROUND with *Vulcanaire*



Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.

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A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

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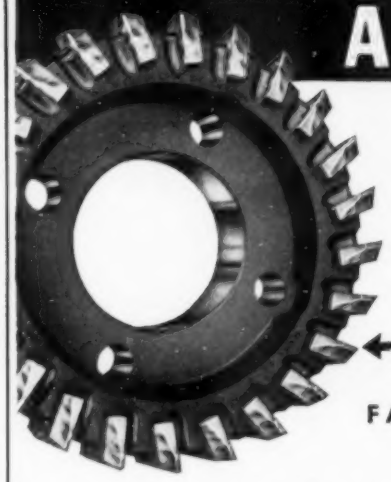
PRODUCTION TOOLS BY **APEX**



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This milling cutter can be had in fine tooth or heavy duty style when required. Blades are adjustable for wear. Furnished with H.S., cobalt or carbide tipped blades. Body DROP FORGED and heat treated.

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Stops Losses making Dies and Templates

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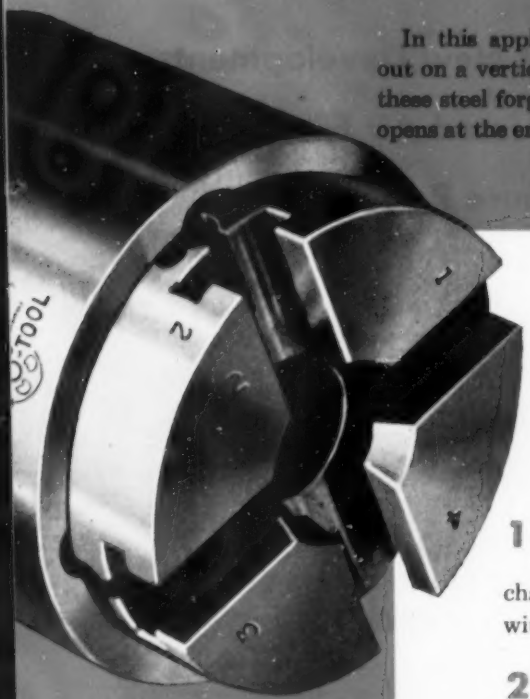
cuts costs . . . speeds production on end turning and forming

In this application 300 lever supports an hour are turned out on a vertical six-spindle automatic. Vers-O-Tool machines these steel forgings three times faster than single point tools, opens at the end of the cut, leaves no spiral marks on the work.



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VERS-O-TOOL

LICKS PRODUCTION PROBLEMS BECAUSE:

1 Basic Vers-O-Tool design permits cutters or ground thread chasers to be changed quickly without adjustments in the head.

2 All settings in the blocks are made in the toolroom with a micrometer gauge—no need for trial and error run after changing or grinding.

3 Simplicity of basic design means fewer moving parts—insuring long, trouble-free performance.

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2. ROUGH TURN STEM DIAMETER AND ROUGH FACE SHOULDER
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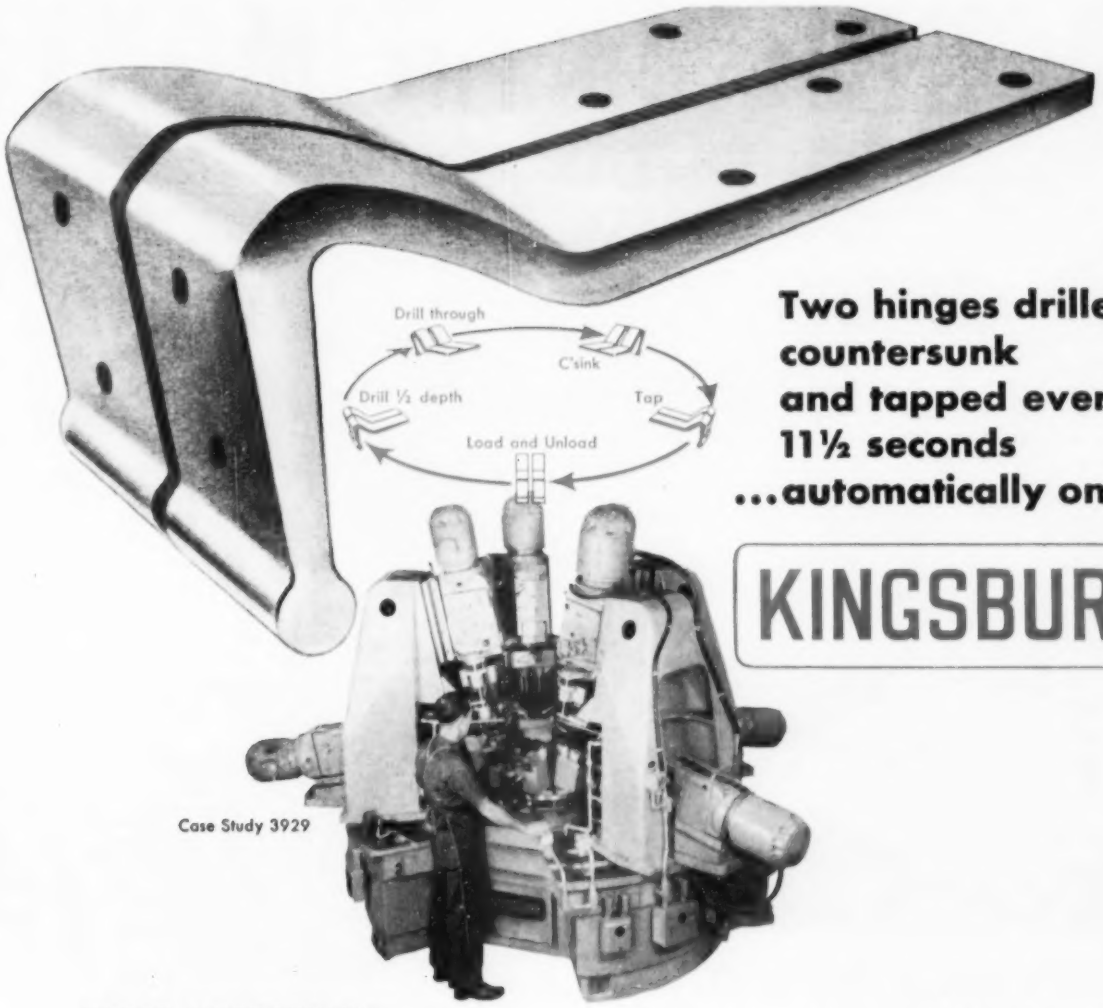
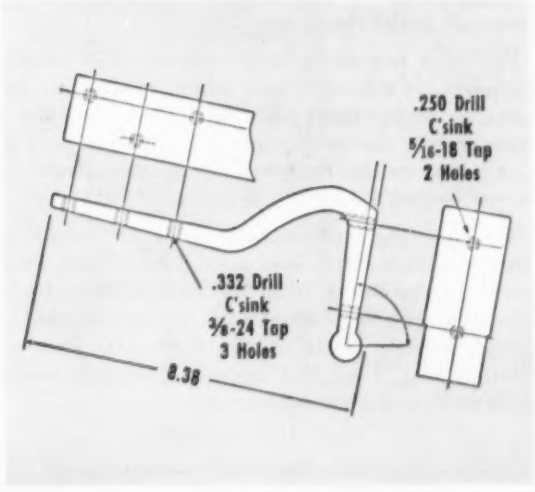


Case Study 3929

Two hinges drilled, countersunk and tapped every 11½ seconds ...automatically on a KINGSBURY

THREE OPERATIONS FROM TWO DIRECTIONS ON THIS FORGED STEEL HINGE ...620 PARTS PER HOUR GROSS



The print shows the angle at which the fixtures hold the work. This angle allows room for four vertical units (three visible in the photo). Each fixture holds two parts. The four vertical units drill half depth, drill through, countersink and tap three holes in each part. Two-step drilling shortens the time cycle and increases the production rate. Four angular units (only three visible in photo) perform similar operations on the two holes. The operator unloads a finished part, loads a rough one and pushes a button to index the table. After the table indexes, all units operate automatically.

All Kingsbury machines are completely tooled and ready to produce. We run test samples and ship them to you for your approval before we ship the machine. For high production drilling and tapping, a Kingsbury is the best machine you can buy. May we talk to you about your jobs?
Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY
INDEXING AUTOMATICS
for high production drilling and tapping

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

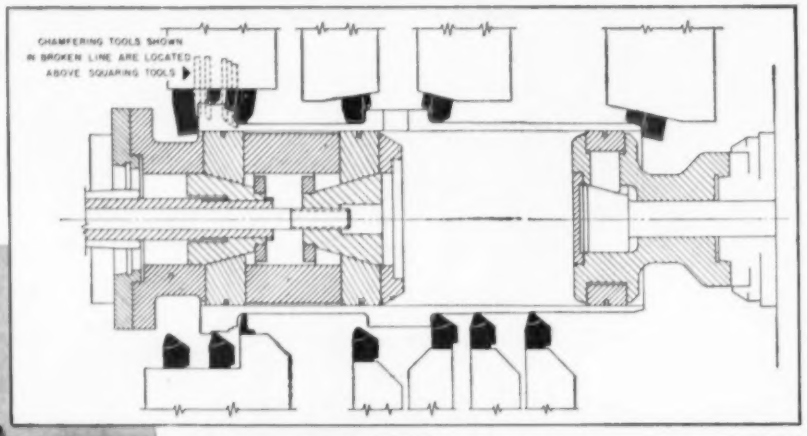
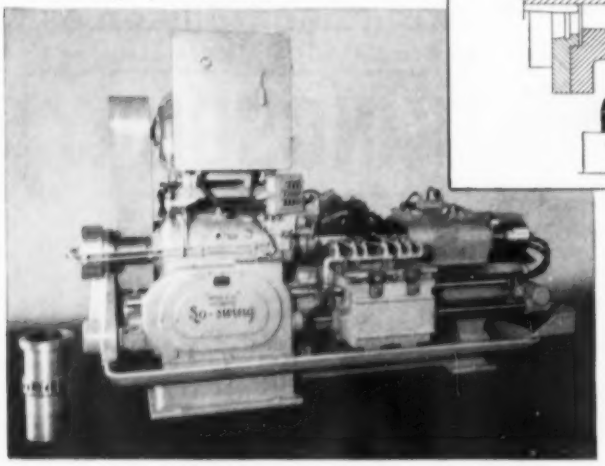


Fig. 1. Details of arbor construction and location of 22 cutting tools.

Fig. 2. Model R-18 Lo-swing Lathe equipped for machining large cylinder liners.



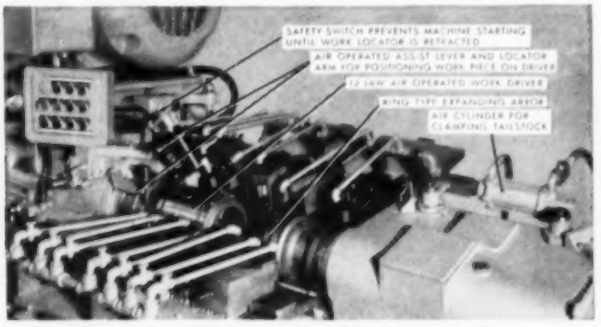

SAFETY SWITCH PREVENTS MACHINE STARTING UNTIL WORK LOCATOR IS RETRACTED
AIR OPERATED ASSIST LEVER AND LOCATOR ARM FOR POSITIONING WORK PIECE ON DRIVER
12 JAW AIR OPERATED WORK DRIVER
RING TYPE EXPANDING ARBOR
AIR CYLINDER FOR CLAMPING TAILSTOCK

Fig. 3. Close-up view of special tooling and tailstock.

SENECA FALLS AUTOMATIC LATHES CUT MACHINING COSTS ON ROAD BUILDING EQUIPMENT

Today's mammoth Road Building Tractors and Machinery require the most modern and heaviest machine tools to complement the fine engineering and manufacturing skills of Construction Equipment Manufacturers.

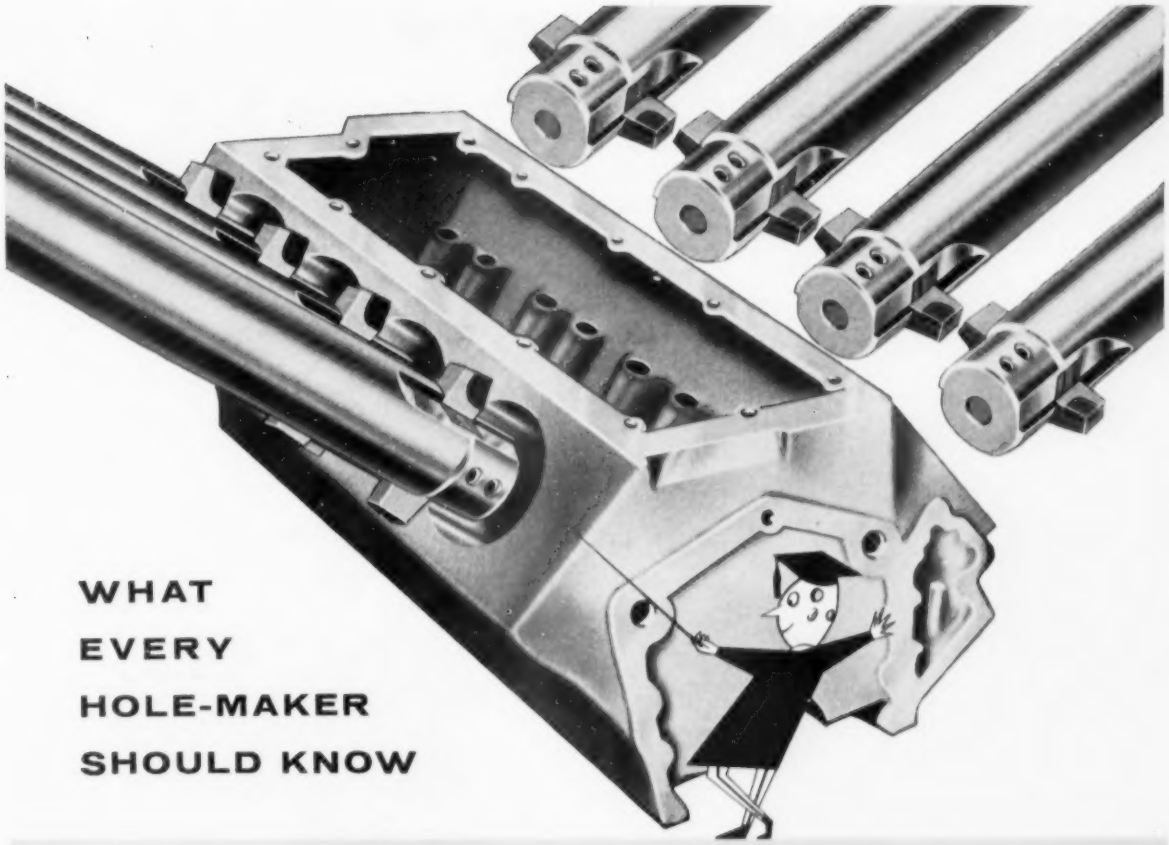
The Model "R-18" Automatic Lo-swing Lathe has already demonstrated its fine performance with carbide tools in Construction Equipment Plants. Its rigid construction and ability to stand up under the heaviest cuts, coupled with positive mechanical feeds, wide flexibility and servicing simplicity, are all important advantages of the Model "R" type of Lo-swing Lathes.

Figure 2 illustrates a Model "R-18" Lathe equipped for turning, facing and chamfering operations on large Cylinder Liners 11½" diameter by 22" long. The liner is held and driven by a special driver, mounted on the headstock spindle, which has two rows of six air-operated driving jaws. Each row is operated by its individual pull bar, thus equalizing the air pressure on both sets of jaws, which are positioned at the point where the liner wall is the thickest.

The liner is positioned on the driver in relation to the ports, by a locator arm which enters one of the ports. An air-operated assist lever then holds the liner tight against the locator until the driving jaws grasp it. A safety switch prevents the machine from being started before the locator is retracted.

The relieving type tailstock has a 20" stroke, operated by a motorized lead screw, permitting easy removal of the liners from the long driver. Its large revolving spindle is fitted with an air-operated, ring type, expanding arbor which supports the liner at the tailstock end. A 60 H. P. motor drives the machine. Floor to floor time is 5.2 minutes.

PRODUCTION COSTS ARE LOWER WITH Lo-swing



WHAT EVERY HOLE-MAKER SHOULD KNOW

ABOUT MADISON ROUGH AND FINISH BORING TOOLS

Let the man with the holes in his head tell you how to cut costs in:

- ★ **Boring**
- ★ **Reaming**
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- ★ **Gaging**

Interchangeability — Cutters are changed in seconds without removing bars from machine because all Madison cutters are presized and uniform . . . minimum down time.

Controlled Float — Exclusive Madison feature lets cutter float in bar at point of cutting action, eliminates need for costly special floating tool holders.

Free Cutting Action — Two cutting edges leave room for chip clearance and coolant circulation, prevent damage to tool and work from overheating.

One-Screw Adjustment — Micrometer adjusting screw sets tool to exact desired size. Work is held to closer tolerances. Madison expansion feature assures maximum cutter life.

Your Madison Man would like to tell you about other Roughing and Finishing Tool features — and demonstrate their benefits on *your* holes. Send coupon.

Inner Diameters Are Our Business

MADISON
INDUSTRIES INC.
Muskegon, Michigan

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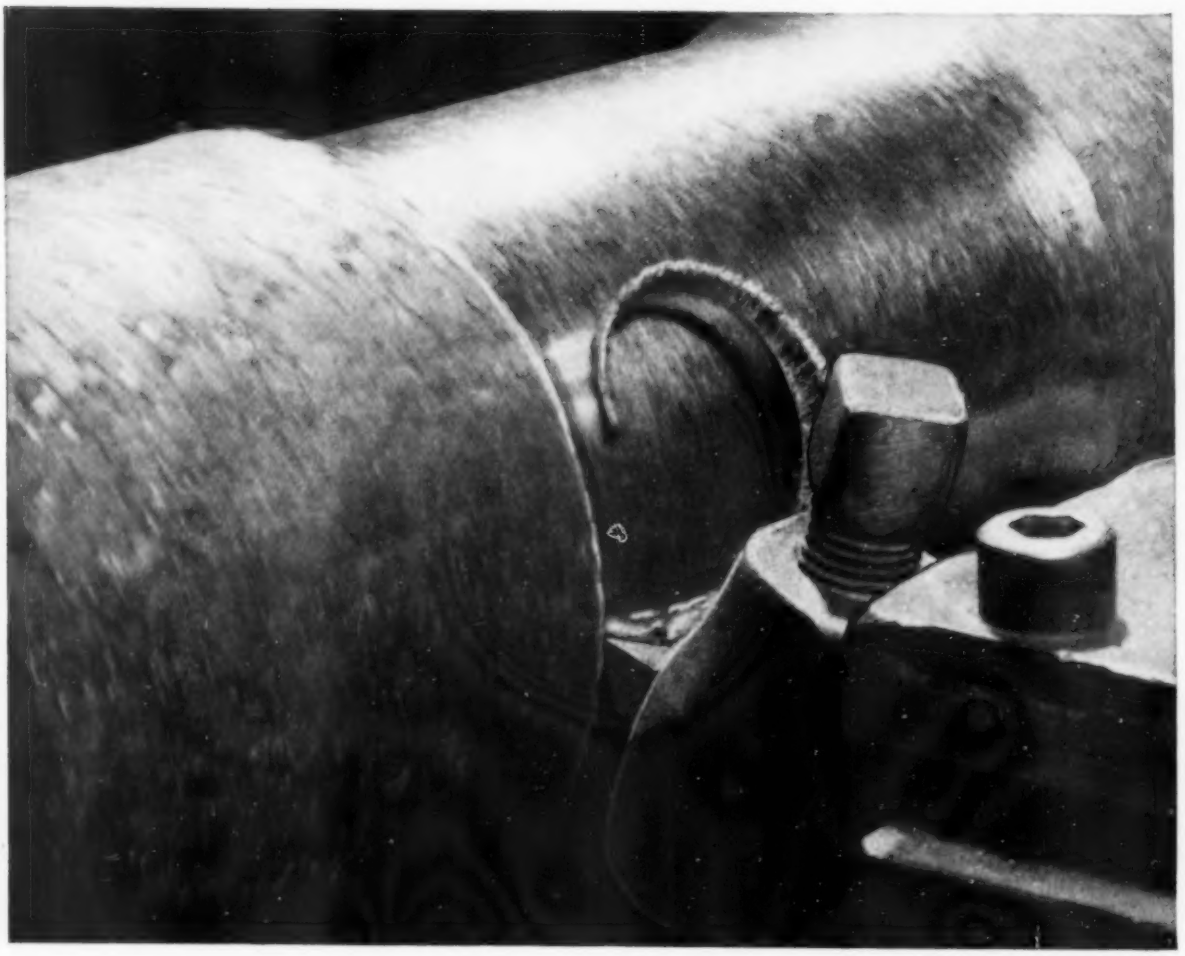

One Pound of Metal Removed Per Minute

Two HAYNES STELLITE alloy tools remove 118 cubic inches of metal from rough, uneven nickel-chromium billets in 20 minutes. They trim ½ in. from the diameter in one pass, and finish two of the 170-lb. billets per grind. Each tool removes about a pound of metal per minute in spite of the irregularity of the billet. Cutting speed is 37 surface ft. per minute and the rate of feed is $\frac{5}{8}$ in. per minute. Heat generated during the cutting operation quickly dulled the cutting edges of high-speed steel tools tried on this job, and the rough cut caused other tool materials to chip. Only HAYNES STELLITE 98M2 cobalt-base alloy tools proved to be both hard and tough enough to do the job efficiently.

HAYNES STELLITE alloy tools are successful on applications like this one because they have good impact strength, high compressive strength, and their cutting edges remain hard and sharp even when red hot. They remove metal fast. They can be used at high speeds with comparatively high feed rates, and they take deep cuts.

More information on HAYNES STELLITE tools and how they can be used to best advantage is contained in the booklet, "HAYNES STELLITE Metal-Cutting Tools." Write any of the district offices listed below for your copy.

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HAYNES STELLITE COMPANY

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Transmission pinion pin

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Bevel gear

Steering arm ball stud

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Cincinnati does both—selective flame or induction hardening—and the parts shown at right are typical of those that can be hardened by either method. If that's your situation, then talk to Cincinnati . . . headquarters for equipment that gives you the hardness wanted, where it's wanted, using the heat source most economical for you. Use electric power—or acetylene, propane, natural or manufactured gas—whichever is readily available to you or provides lowest cost.

Whether flame or induction, you can be assured of heat-treating machinery that will deliver the hardness you specify, and meet your cost-per-piece requirements, on high production quantities or varied, small-lot runs. It will be excellently engineered, equipped with the finest of components, thoroughly safeguarded, easily maintained.

Call in a Process Machinery Division field engineer. He is ideally equipped to evaluate your needs and give you unbiased recommendations as to the most economical equipment for your selective surface hardening work.

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flamatic and inductron *hardening machines*

THE PROCESS MACHINERY DIVISION

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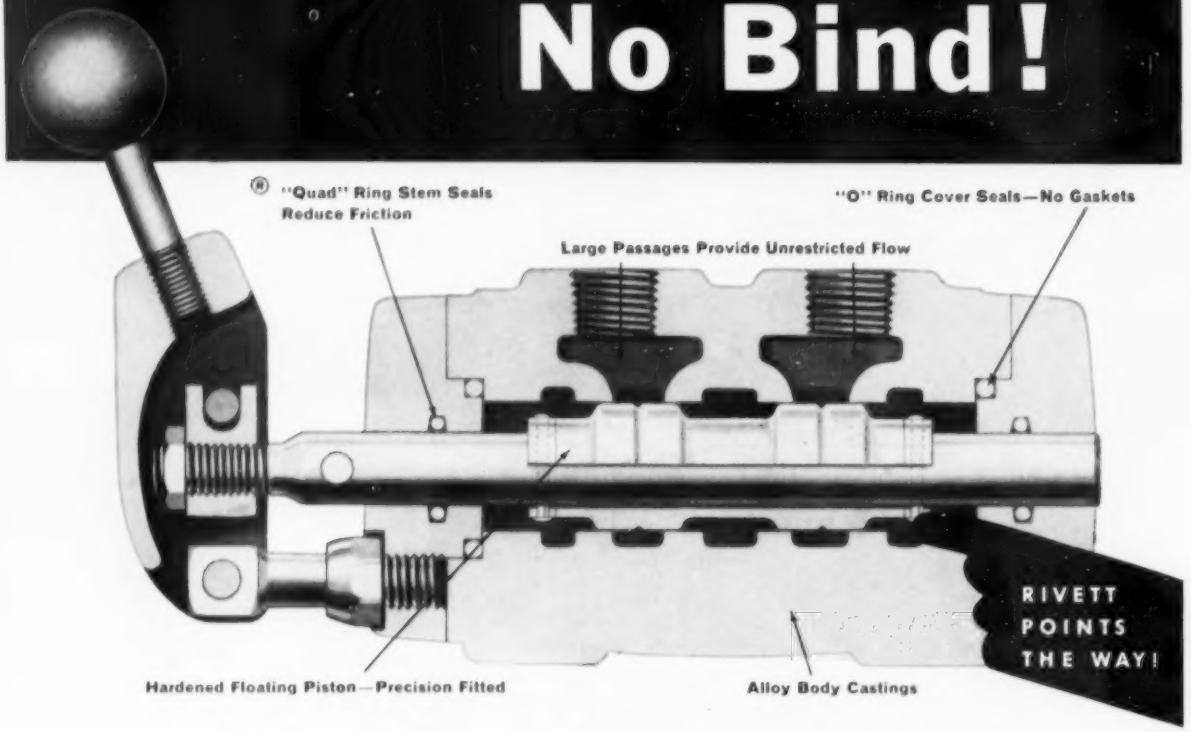
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Large Passages Provide Unrestricted Flow
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Alloy Body Castings

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Valve Stem is Independent of Valve Bore
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For fast, smooth cutting of aluminum flats, billets, rods, extrusions . . . or any other soft metals and materials . . . Simonds has the right saw or file for any particular job. Made of special job-rated Simonds steels . . . by top men working under ideal controlled conditions in Simonds famed windowless factory . . . every Simonds tool has the bonus-factor of finest performance and longest life. Yes, on any metal-cutting job, remember: "Say Simonds . . . *and save*".

SOLID TOOTH SAWS
For best performance on automatic cut-off machines or saw tables and general run of work. Also furnished with carbide tips for production cutting.

SEGMENTAL TYPE SAWS
For thin wall sections and for smoother cutting of billets and thicker sections. Made with replaceable High Speed Steel teeth in segments.

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For heavy duty cutting of billets and heavy sections. Replaceable High Speed Steel teeth.

"SABRE TOOTH" BAND SAWS
New design saw features a special tooth *with a hook*, for freer, faster cutting.

"RED END" HACK SAW BLADES
3 types, for hand or power cutting, each available in standard sizes and tooth-spacings, enable you to choose the one best blade for each job.

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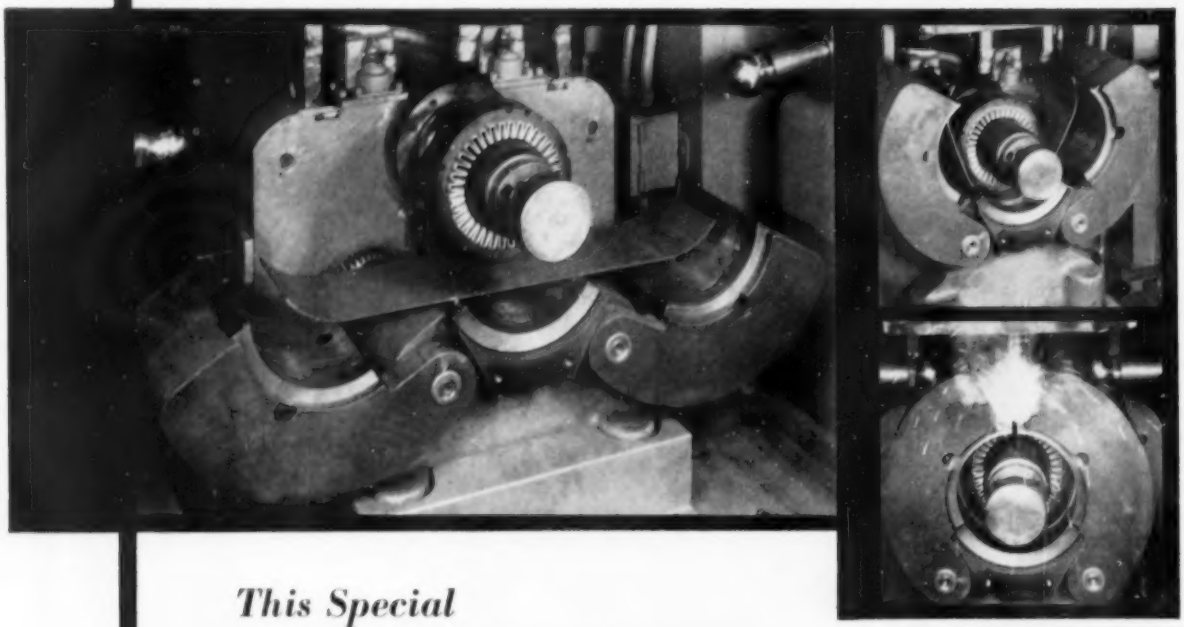
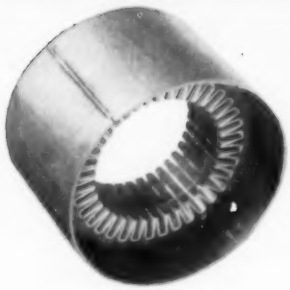
Another Special by **STANDARD–MODERN**



This Special
AUTOMATIC WELDER

precision forms and welds stator core assemblies in 36 seconds*



The time-consuming process of wrapping stator cores for fractional horsepower electric motors is reduced to a swift, precision job by this Standard-Modern Automatic Welder.

The operator simply places a strip of flat steel stock with preformed ends under the wound stator core, which is held on a central spigot, and presses the cycle start buttons.

Steel jaws wrap and clamp the strip around the core, leaving a gap of about 1/32 inch. With an inert gas shield and wire filler, the gap is then welded automatically. Shrinkage of the weld permanently binds core and shell together. The forming jaws then automatically release the completed assembly for removal.

A formerly slow and troublesome hand operation is accomplished—accurately and uniformly—in 36 seconds, a fraction of the time formerly taken.

*Average floor to floor time.

STANDARD-MODERN Special Machines are speeding production, saving time and money for industry across Canada.

STANDARD–MODERN
TOOL COMPANY LIMITED
MANUFACTURING DIVISION
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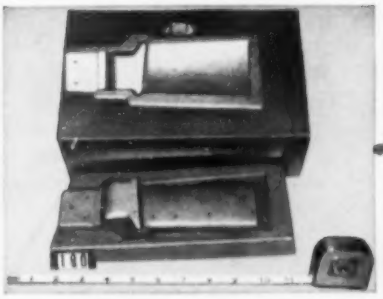
• SP-3 •

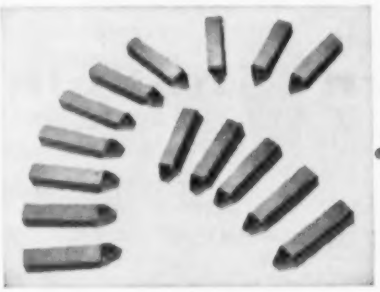
FORGING DIE

Material: Heppenstall 'A'
Conventional Machining
Time: 40 hours
Elox Setup & Machining
Time: 8 hours
Saved: 32 hours
Machine tool: Elox Standard M-500
Electrode: Cast Elo-met #3
Customers report 75% time saving in re-working dies after washout . . . no annealing is necessary.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

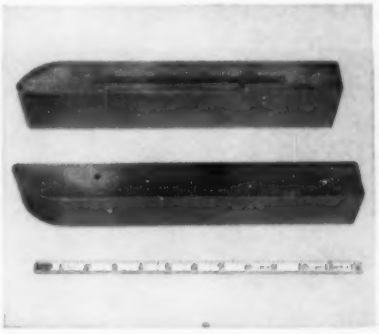
E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.



EMBOSSING DIE

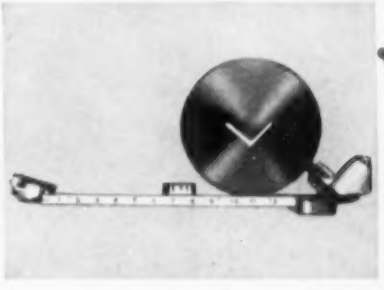
Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining
Time: 227 hours
Elox Setup & Machining
Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass



EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional
Machining Time: 4 hours
Elox Setup &
Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



FROM THE HEART OF EDM

. . . 4 jobs that prove Elox puts you ahead of competition

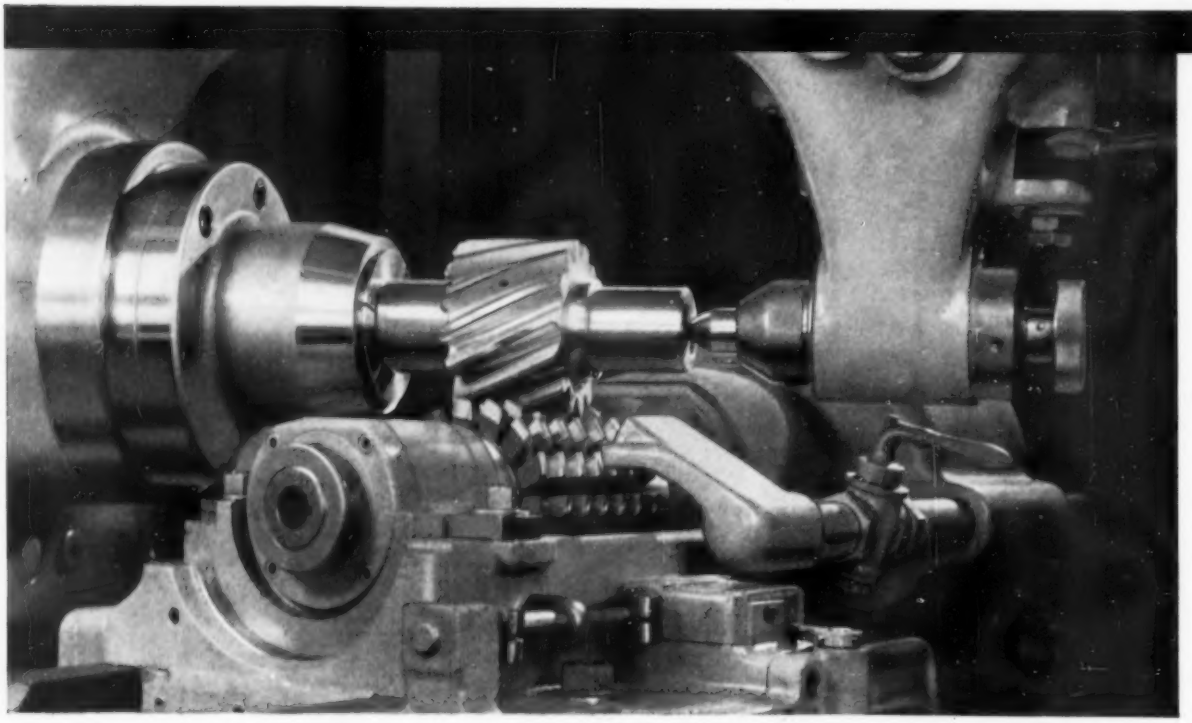
These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox corporation of michigan *T. M. Reg.

1837 N. Stephenson Highway
Royal Oak 3, Michigan

crown hobbing

saves time and cost in producing accurately crowned gears



Crown-hobbing on this special Barber-Colman No. 14-15 Hobbing Machine is an ideal production method of generating crowned gear teeth. Where gears are now hobbed and then crown-finished in a secondary operation, they may be crown-hobbed in one operation. When a hobbed finish is satisfactory, the shaving operation can be completely eliminated. If the degree of finish required calls for a further finishing operation, such gears may be finished after crown-hobbing at less cost and in less time because hobbing provides uniform stock removal.

Crown-hobbing also makes it possible to hold a change in tooth thickness within the desired limits, and the tooth bearing can be located at the most desirable point consistent with the job conditions.

In the operation shown here, 4 DP., 14T, 18° P.A. transmission gears with 2¾" face are crown-hobbed on a special Barber-Colman No. 14-15 Hobbing Machine. Teeth are hobbed with a change in tooth thickness of .0045". The automatic cycle includes rough hobbing R. to L. at a given depth, automatic lowering of the work slide against the crowning cam, climb hobbing L. to R. at a constantly changing depth, and rapid traversing out of cut. No further finishing is required in this particular case, and the gears are completed in one automatic operation, without changing tools or transfer to other machines. Savings on this part can be expected on the basis of the following comparison:

typical gear-crowning	crown-hobbing
Rough hob gear teeth.	Manually unload and load.
Transfer to other machine.	Automatic cycle — rough hob.
Semi-finish hob gear teeth.	R. to L., set to finish depth,
Transfer to next machine.	and crown hob L. to R.
Crown-finish gear teeth.	Manually unload and load.

The machine can be designed to suit your job requirements, either as a single-purpose machine, or as a universal machine for both crown and conventional hobbing. Parts can be hobbed in one or two cuts, depending upon specifications of the part. The cam can be designed to produce the tooth configuration required.

The machine required for crown-hobbing is provided with a cam mechanism for raising and lowering the work slide to produce a change in tooth thickness. The work slide is held against the rotary cam by hydraulic pressure in addition to its own weight. Change gears are provided in the cam drive so that different amounts of change in tooth thickness can be produced with the same cam.

Send us drawings of your crowned-gears. Our engineers will analyze the job conditions and make recommendations for crown-hobbing.

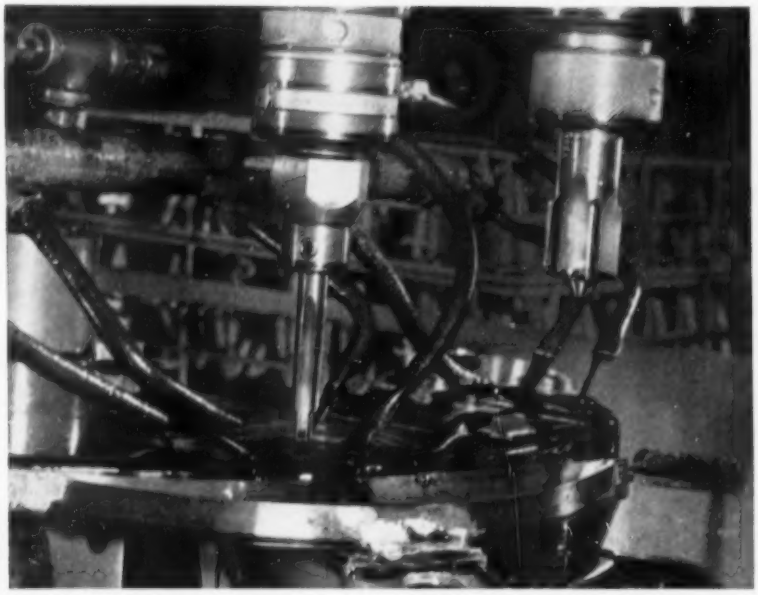
BARBER-COLMAN COMPANY

782 ROCK STREET • ROCKFORD, ILLINOIS

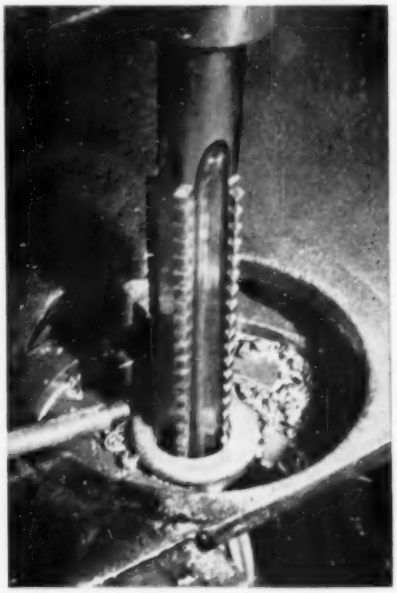
Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

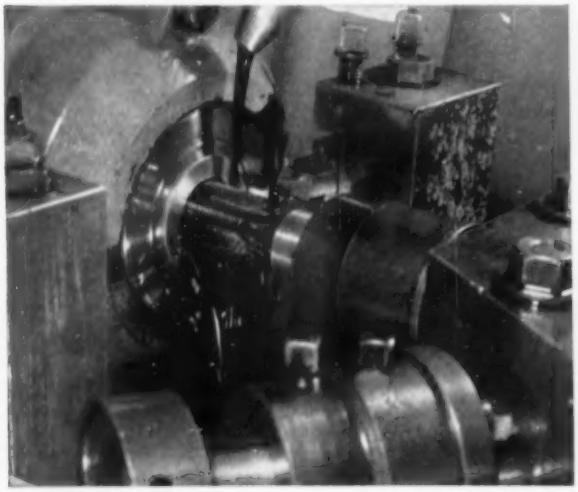
Cutting Tool and Gaging Methods . . . by BESLY



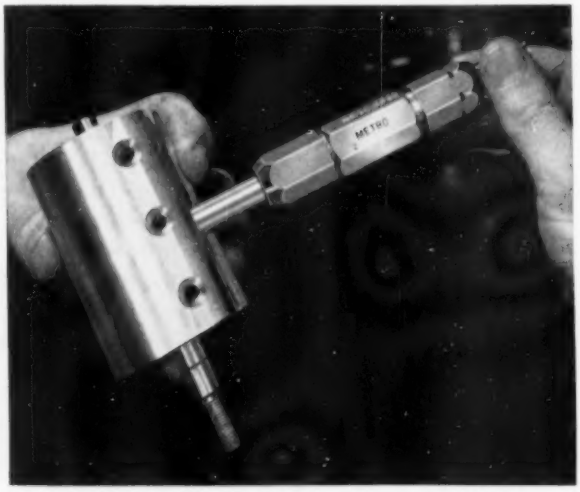
MATCHED TO THE JOB — At The Chicago Screw Company, Bellwood, Illinois, two sizes of Besly taps, poised above an indexing table, are ready to tap C-1141 steel parts. Operating alternately, the smaller $\frac{3}{8}$"-24 Besly tap quickly threads a hole, then the work indexes beneath the $1\frac{3}{32}$"-24 Besly tap and a larger hole is threaded. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were carefully selected and matched to the specific threading requirements.



SQUARED OFF — Templeton, Kenly & Company, Broadview, Ill. cuts heavy, almost square threads in malleable iron bases of rugged 12 to 24-ton screw jacks with Besly acme threadform Taps. Notice mirror finish on flutes promoting greater chip clearance.



TOUGH GOING — Here you see a C-1018 high carbon steel nut being threaded by a Besly $1\frac{3}{4}$" tap. Extremely abrasive, because it has been carburized and heat treated, the material is difficult to tap. However, Besly taps tested on the work, proved they could "take it" and were specified by this manufacturer for the job.



ASSURED ACCURACY — To assure that holes in planer cutter head assemblies provide precise fits for set screws, SKIL Corporation, Chicago, checks for accuracy with Besly-Metro Double End Reversible Cylindrical Plug Gages. Two opposed blades have three holding set-screws and another for adjusting position.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details or write us . . .

Engineering, Service and "Specials" . . . are a Besly Specialty

BESLY

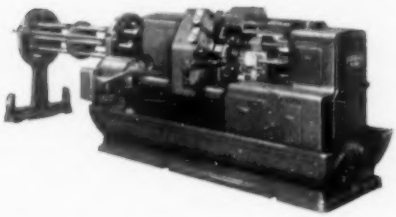
BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
118 Dearborn Avenue
South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, THROWAWAY INSERTS and HOLDERS

FROM DIESEL ENGINE TO ICE-CREAM FREEZER PARTS

AUTOMATIC BAR MACHINES

Handle All Types of Jobs



SIX AND FOUR-SPINDLE AUTOMATIC BAR MACHINES

GREENLEE Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Hydro-Borer Precision Boring Machines

✓ ***Efficiently...***
✓ ***Economically***

Greenlee design permits the handling of a wide variety of operations at various spindle positions . . . makes it easier to split up long operations . . . reduces idling time.

Threading, tapping and reaming can be performed in 3rd, 4th, 5th and 6th positions . . . a special Greenlee advantage. Seven full-length T-slots on the main tool slide will accommodate the tools and attachments needed for a wide range of set-ups. Interchangeable cross-slide tooling and simplified cross-slide camming contribute to greater flexibility and faster set-ups.

Investigate! Ask any owner or operator . . . they'll tell you that Greenlee is one of the most highly respected names in its field.

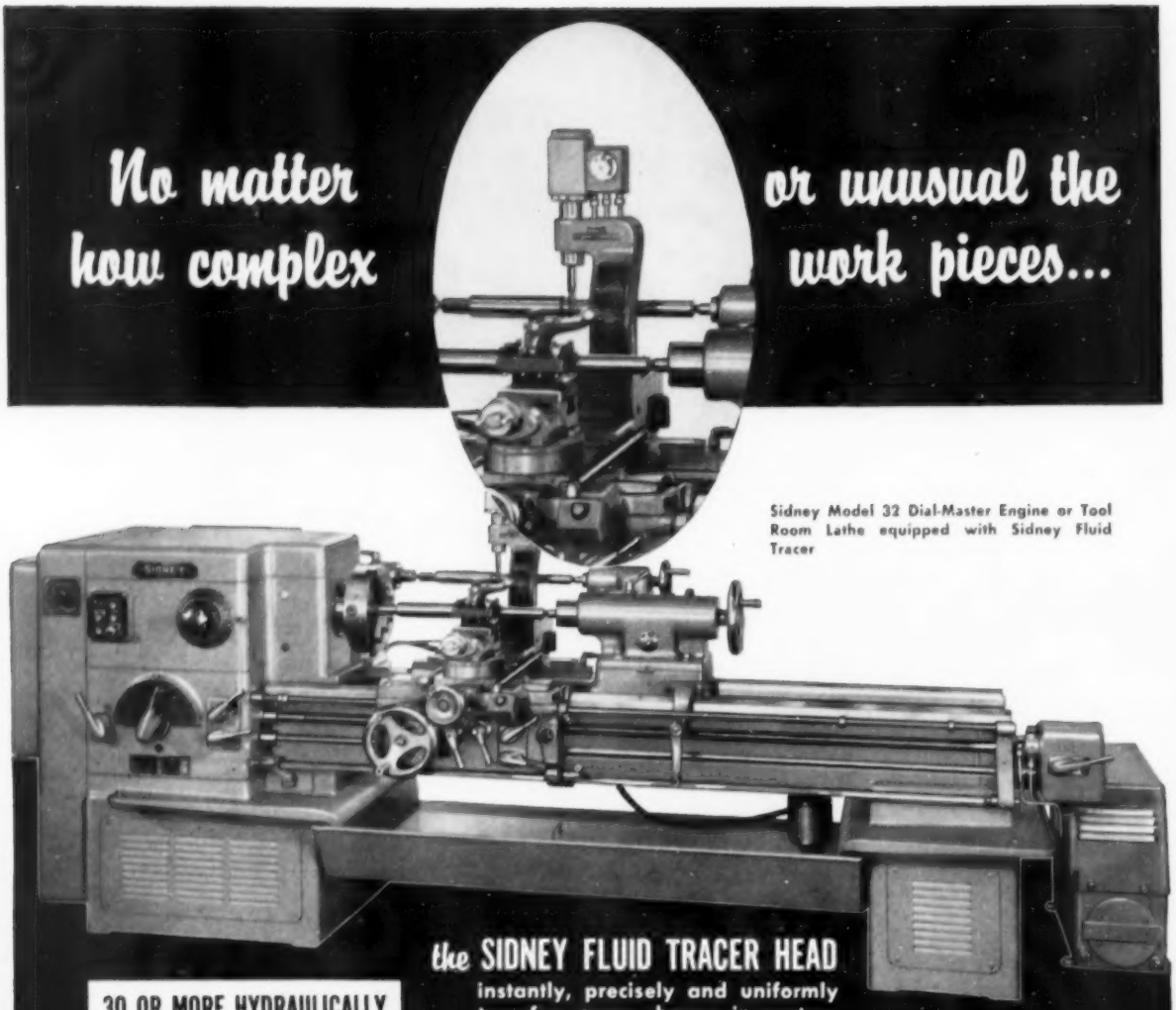
Write for Catalog No. A-405

GREENLEE BROS. & CO.

**1982 MASON AVE.
ROCKFORD, ILL.**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-259

No matter how complex or unusual the work pieces...



Sidney Model 32 Dial-Master Engine or Tool Room Lathe equipped with Sidney Fluid Tracer

30 OR MORE HYDRAULICALLY CONTROLLED PRE-SELECTIVE SPINDLE SPEEDS

A revolutionary innovation and presented as a "SIDNEY FIRST" as long ago as the Machine Tool Show of 1947 . . . used regularly as a standard SIDNEY feature ever since. But only recently adapted by other lathe manufacturers . . . a fitting tribute to SIDNEY pioneering and leadership.

the SIDNEY FLUID TRACER HEAD

instantly, precisely and uniformly transfers every change in contour from the master piece or template to the cutting tool. It also controls the hydraulically actuated cross feed and the longitudinal movement of the carriage.

THE SIDNEY FLUID TRACER can be furnished in connection with any size or model of SIDNEY LATHE. Small runs or quantity production runs show tremendous savings in cost per finished piece. Changeover to standard lathe operation or back to tracer control requires just a few seconds. No addition or removal of parts is necessary because the tracer motor may be turned off while the lathe does standard lathe work.

Look at what work you can turn with the SIDNEY FLUID TRACER attachment:

IT'S "SUPER" IN EVERY WAY

SUPER SWIFT...

SUPER ECONOMICAL...

SUPER SENSITIVE!

Write for new bulletins or ask for representative to call

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904

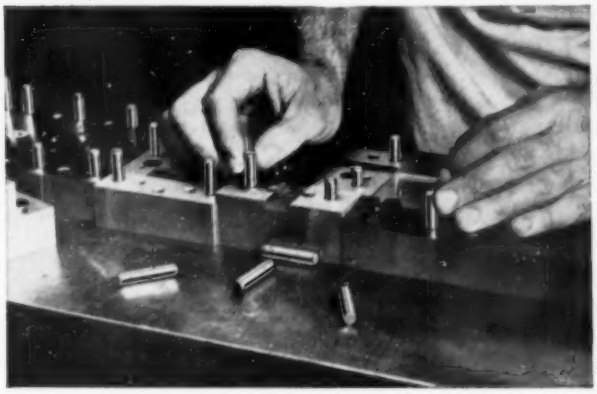
"STOCK ANSWER"
to many a design problem

ALLEN DOWEL PINS

ALLEN DOWEL PINS are being profitably employed in a thousand and one ingenious ways beyond their conventional applications in tool and die work — as economical roller bearings, as axles, precision plugs, hinges and wrist pins to name a few.

If you have an application that will utilize the great strength, accuracy and fine finish of Allen Dowel Pins, you can save substantially on the cost of your product — because you can secure them at favorable prices right from your Allen Distributor's stock.

Check the quick facts at the right and write directly to Allen's Engineering Department for further technical information.



SPECIFICATIONS

- Made from Allenoy heat treated steel. Surface hardness 62-64, Rockwell C scale; core hardness 52-54. Case depth .010" to .020" depending on size.
- Single shear strength 160,000 to 180,000 p.s.i.
- Surfaces precision ground to ± .0001" with micro-inch finish of 6 RMS max.
- Sizes: Diameters, ⅛" to 1". Lengths, ⅜" to 6".
- Two standard oversizes — .0002 for press fits between mating parts, or .001 for repair work, or holes machined oversize.

ALLEN HEAD

ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-261

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY
ABERDEEN, SOUTH DAKOTA

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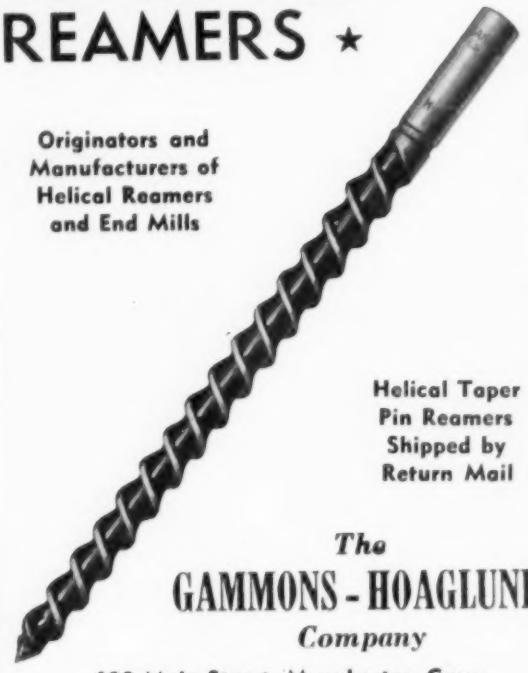
GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS - HOAGLUND
Company
400 Main Street, Manchester, Conn.

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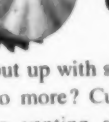
PRECISION CUTTERS!

MADE TO YOUR EXACT SPECS... SOLID CARBIDE, OR CARBIDE TIPPED!

Why put up with stock cutters, when made-to-order cutters cost no more? Cutters designed for specific gang-milling, slotting, venting, slitting or grooving operations in various diameters and thickness to suit YOUR needs exactly. Fast service: all component materials carried in stock. Top-flight reputation for dependability built since 1888. Furnish complete specs, quantities desired and material to be cut when requesting prices. Write for Bulletin No. **52**



W. F. MEYERS CO., INC., BEDFORD, INDIANA

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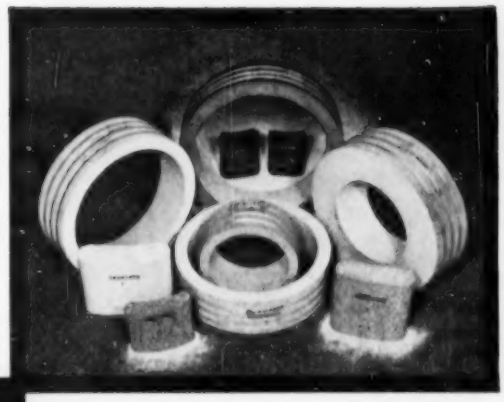
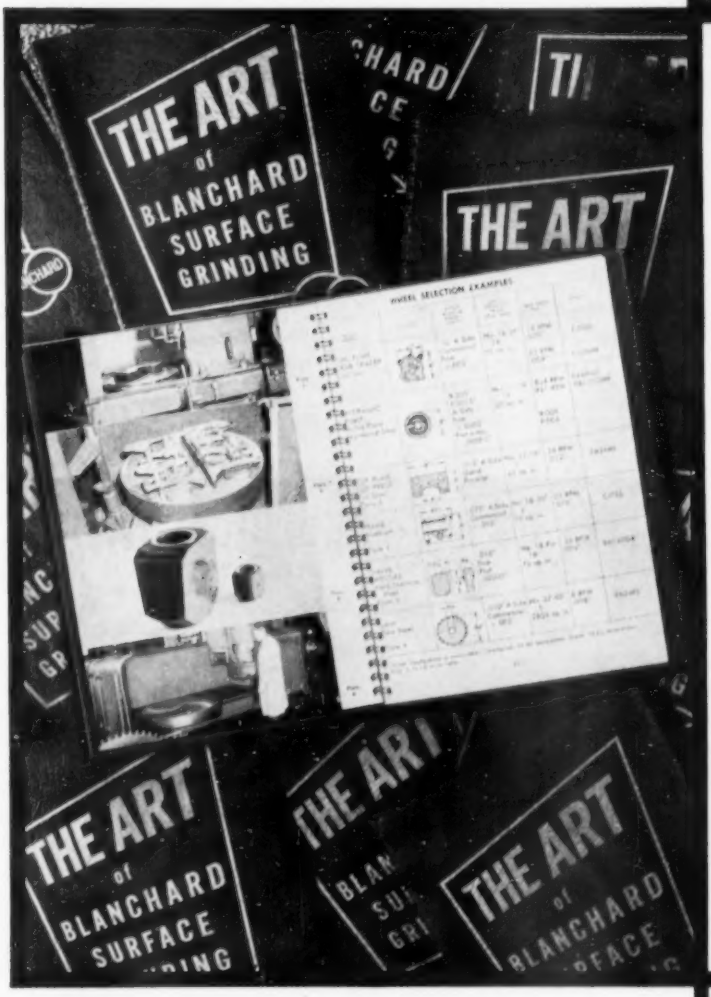
FREE!

Page after page shows the correct abrasive wheel to use

(for the best Blanchard grinding results)



Blanchard wheels in silicate, resinoid and vitrified bonds.



This is our famous booklet *The Art of Blanchard Surface Grinding* — brought up-to-date with a third edition. It contains complete descriptions of our silicate, resinoid and vitrified bonded wheels. It also describes a number of jobs and shows you how to select the correct wheel for each job. Every Blanchard operator should have a copy handy — send for yours today.

Blanchard wheels are guaranteed for uniformity of grade. They're best for Blanchard grinders, best for every job. They give you maximum production, utmost economy . . . whether the work is tough as copper or fragile as glass, whether it requires heavy roughing cuts or precision grinding within .000010" of absolute flatness and surface finish of 1 micro-inch.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS.

THE BLANCHARD MACHINE CO. T
64 State St., Cambridge 39, Mass.

Gentlemen:

Please send me a free copy of "*The Art of Blanchard Surface Grinding*" (3rd Edition).

NAME .....

FIRM .....

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CITY ..... ZONE ..... STATE .....

Users tell you . . .

How Norton wheels cut O.D. grinding costs and improve quality

Here's the "Touch of Gold" to give your cylindrical and centerless grinding great advantages

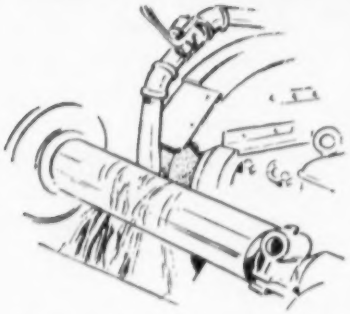
Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per wheel and dressing . . . easier dressing, with less wear on diamond or crushing roll.

Those are typical benefits reported by Norton G Bond and BE Bond wheel users all over the country — concerning every type of O.D. grinding.

It's all because both G Bond and BE Bond are so particularly well adapted to the needs of cylindrical and centerless grinding. Wheels made with them hold each abrasive grain just long enough for maximum cutting action — and outperform all other wheels in many grinding operations, precision or semi-precision. The new Norton "44" ALUNDUM abrasive is proving to be the most outstanding non-premium-priced abrasive for many O.D. grinding jobs.

Here we can show just a few of the on-the-job photos and facts passed on to us. Look them over — and note how these wheels can add the "Touch of Gold" that will boost your own product quality and profits.

Typical Performance Reports on "44" ALUNDUM* Abrasive

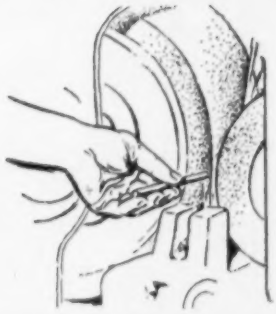


CYLINDRICAL GRINDING

A WISCONSIN PLANT, grinding 2″ to 4″ diameter steel shafts, 12″ length, reports 44 ALUNDUM wheels (44A54-KVBE) cut faster and cooler with no sacrifice of wheel life, compared with best previously used wheels.

A MICHIGAN PLANT, grinding miscellaneous high speed steel bolt heading dies finds 44 ALUNDUM wheels best. Reasons are more pieces per dressing, cooler cutting action and 30% longer wheel life than formerly used wheels.

A NEW JERSEY PLANT found a 44 ALUNDUM wheel (44A36-MVBE), plunge grinding different steel parts, gave many more pieces per dressing and averaged 15% longer life than wheels they used before.



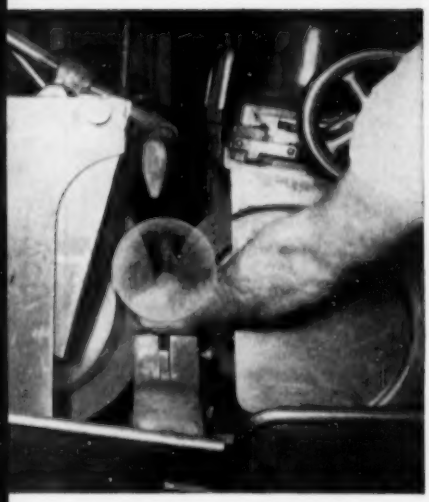
CENTERLESS GRINDING

A MICHIGAN PLANT, of the smaller jobbing types, grinding all kinds of materials. They prefer 44 ALUNDUM wheels (44A801-NVBE) for versatility, less dressing and faster cutting — including 10-hour completion of a job which used to take 14 hours.

AN OHIO PLANT removes .008″ on the rough grind and .003″ on the semi-finish grinding of No. 1010 steel crankshaft pins, ¾″ diameter x 4″ length. While standard wheels gave them an average of 600 pieces per dressing, they report a 44 ALUNDUM wheel produced 1,000 pieces, by retaining its sharp cutting face longer. All stock was removed in one pass, compared with two passes formerly required.

ANOTHER MICHIGAN PLANT, of large size, tested a 44 ALUNDUM wheel in grinding hardened steel tappets. They report more pieces per dressing, faster cut and less burn than ever obtained before.

"G BOND WHEELS LAST US UP TO 40% LONGER," reports this centerless grinding customer. He found that wheel life increased profitably because this greatly improved vitrified bond breaks down so evenly. Workpieces are tapered shank vanadium steel spindles, 10" long with ¼" diameter — plunge ground to remove an average of .045".



"WE NOW GET 800 PIECES PER DRESSING with G Bond wheels, as against 500 pieces with previous wheels. Also, we get 50% longer wheel life, a finer finish, and the shoulder holds up much better." That's the report on this plunge-cut centerless grinding job. Work is a ¼" diameter, 1" long stud from which .012" is removed, to .0005" tolerance and 20 microinch finish.

"WE INCREASED PRODUCTION RATE 35% with G Bond wheels, besides greatly improving finish." These valuable "Touch of Gold" advantages are reported on a cylindrical grinding job calling for .025" stock removal from stainless steel tubing. The operation is also on a Norton machine — a reminder that only Norton offers you such long experience in both grinding machines and grinding wheels, to help you produce more at lower cost.

ASK YOUR NORTON DISTRIBUTOR

for further proof of how Norton O.D. wheels can bring you best possible results. He'll gladly arrange a test in your plant. Distributors in all industrial areas listed under "Grinding Wheels" in the yellow pages of your telephone book. Behr-Manning Division, Troy, New York. *Export:* Norton Behr-Manning Overseas, Inc. **For information write Norton Company, Worcester 6, Mass.**

W-1772

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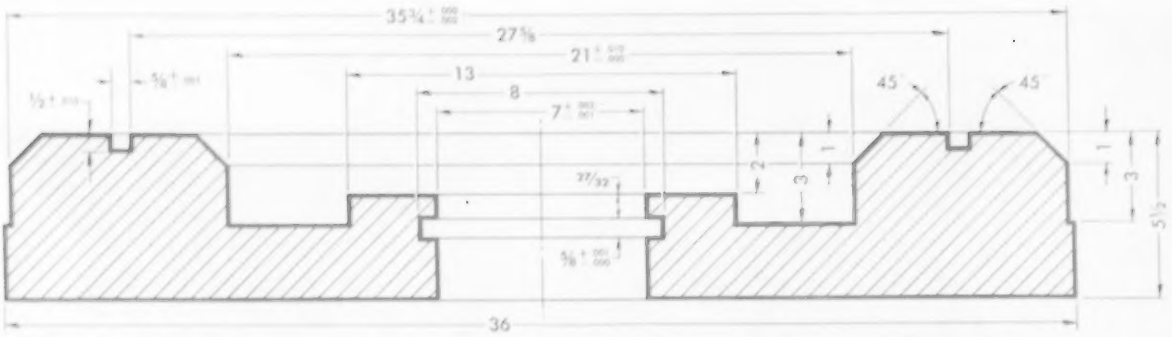
ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories

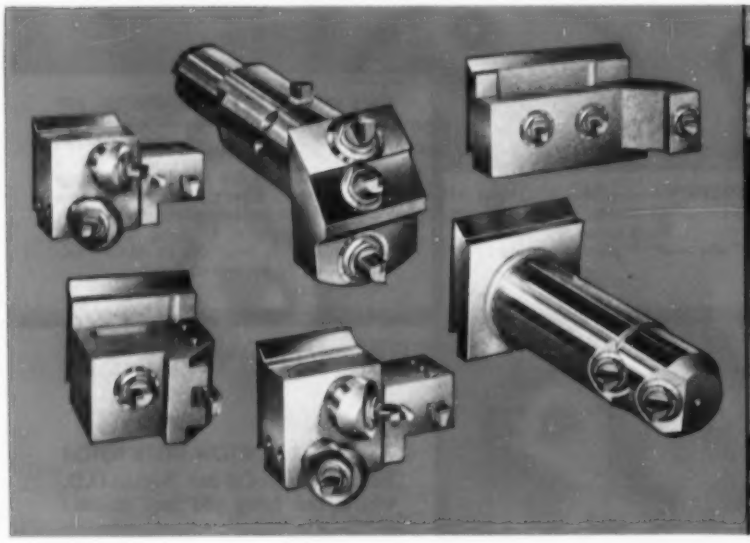
BEHR-MANNING PRODUCTS:
Coated Abrasives • Sharpening Stones
Behr-cat Tapes

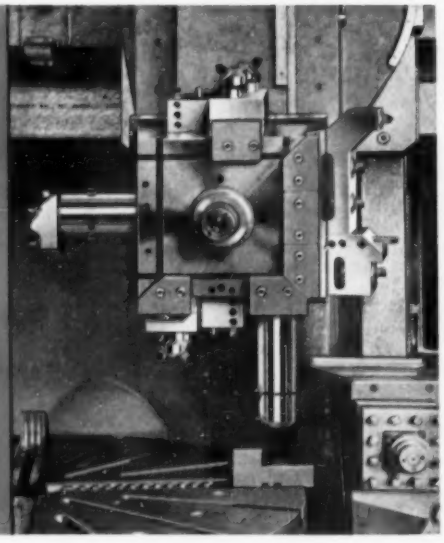
*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries



Certainly you can use Microbore Tooling on a Vertical Boring Mill

HERE'S HOW KING DID IT!





24 OPERATIONS BY CLUSTERING MICROBORE UNITS IN 6 BARS

• This tooling for a difficult job was designed and made by the Microbore Division and was used with great success by the King Machine Tool Division of American Steel Foundries. Notice that boring, facing, chamfering, turning and grooving operations were required and precise limits were held.

• The simple setup and quick adjustment of each individual Microbore unit resulted in a minimum of down time. This is typical of reports from shops where the Microbore System is used. Microbore is a basic tool which can be applied singly or in clusters for all types of precision boring, turning and facing operations.

• Proposal engineering from your prints and machine data is a unique feature of the DeVlieg Microbore System. Discuss your tooling problems with our specialists or let us send you our informative catalog.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

BAY
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A DIRECT LINE TO TAPS

FROM YOU TO THE
WELL-STOCKED SHELVES
OF YOUR NEARBY
INDUSTRIAL SUPPLY DISTRIBUTOR...
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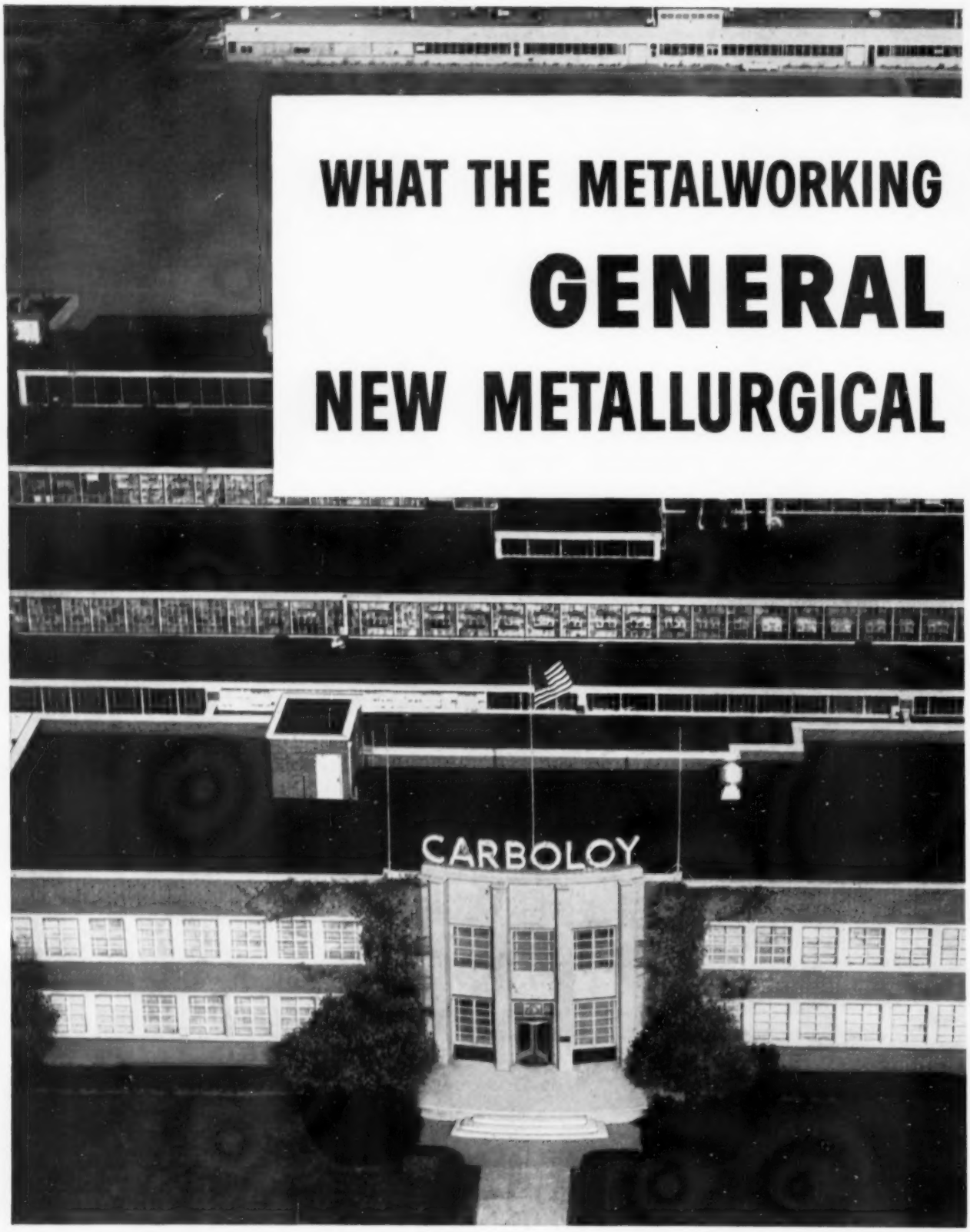
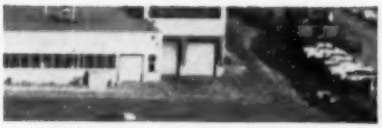
BAY STATE TAPS

BAY STATE TAP & DIE COMPANY
MANSFIELD, MASSACHUSETTS



Headquarters of the Metallurgical Products Department of General Electric Company, 11101 E. 8 Mile Ave., Detroit 32, Michigan. Carboloy Cemented Oxide and carbides are made here. G-E permanent magnets and specialty resistors are manufactured in the Edmore, Mich., plant.



INDUSTRY CAN EXPECT FROM G-E'S METALLURGICAL PRODUCTS DEPARTMENT

The new G-E Metallurgical Products Department is the successor to the Carboloy Department. Here's what this change will mean for you.

Since 1928, the General Electric trademark "Carboloy" has been identified with a brand of cemented carbide. But today, Carboloy® cemented carbides are just one of a broad range of products which bear the famous Carboloy trademark.

Cemented Oxide, the Machinability Computer, toolholders, diamond dressers, drawing and forming dies . . . these are on the market today. Tomorrow, you will see many other new-product developments for the Metalworking Industry.

With carbides like the new Extra-Performance Series 300 steel-cutting grades, these products are being made available to you through a distribution team which is unmatched in the carbide industry from the standpoint of inventory, delivery, and service.

In addition, the Metallurgical Products Department makes other products which carry only the General Electric trademark: permanent magnets, vacuum-melted alloys, hevimet, thermistors, and Thyrite® varistors. And on the industrial horizon are G-E man-made diamonds.

Thus, the new departmental name symbolizes the broadened scope of this Department's activities. Equally important, it indicates how vitally interested General Electric is in the Metalworking Industry.

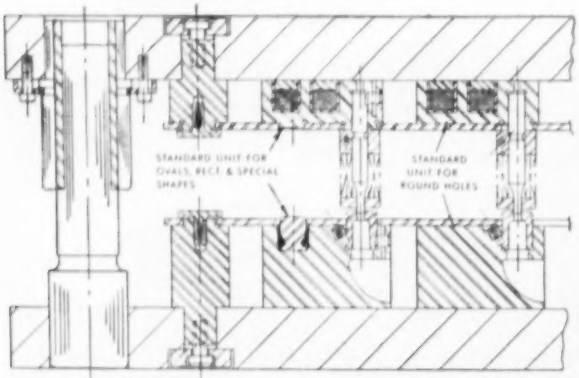
Many of the products listed above are the result of fundamental investigations carried out at the G-E Research Laboratory in Schenectady. Many new developments in machining, forming, and drawing techniques are the work of G-E Engineers. And, when new products and methods are developed for the Metalworking Industry by General Electric, they, too, will come to you from the Metallurgical Products Department.

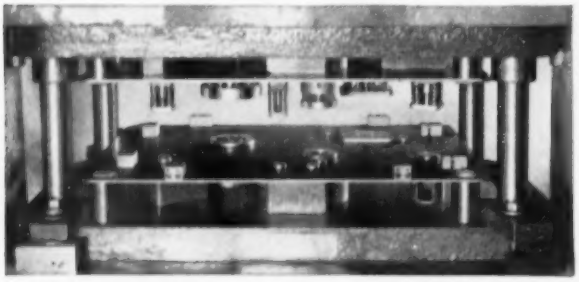
Progress Is Our Most Important Product

GENERAL ELECTRIC

MAGNETIC DIES by WHISTLER

• Operate like a single-purpose die • All punch and die parts interchangeable • Pierce metals up to ¼" thick steel • Changes made from one operation to another while the die set is in the press • Change-over time from 5 to 20 minutes, depending upon size of die set • Lower die costs • Saves die storage space • Precision work in any size press • Backed by Whistler's 40 years of die making experience serving the nation's leading plants.





YOU NEED THIS CATALOG... Shows by photos, drawings and prices how the Magnetic Die* system drastically cuts die costs, saves valuable time, speeds production. *Write for it today.*

*Whistler Magnetic Dies are fully patented and are sold under the registered trade name Magna-Die.

S. B. WHISTLER & SONS, INC.
744 Military Road, Buffalo 23, N.Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

1957—Our 40th Year Manufacturing Dies
USE READER SERVICE CARD; INDICATE A-2-270-1

FREE—New Bulletin T-1 shows, describes VAILL tube end forming machine VERSATILITY for . . .

Beading • Flaring • Flanging • Sinking
Expanding • Grooving • Threading • Reducing
Double Lap Flaring • Double Lap Flanging

on Tubing up to 6" Diam.

THE VAILL ENGINEERING CO.
131 E. MAIN STREET WATERBURY 20, CONN.

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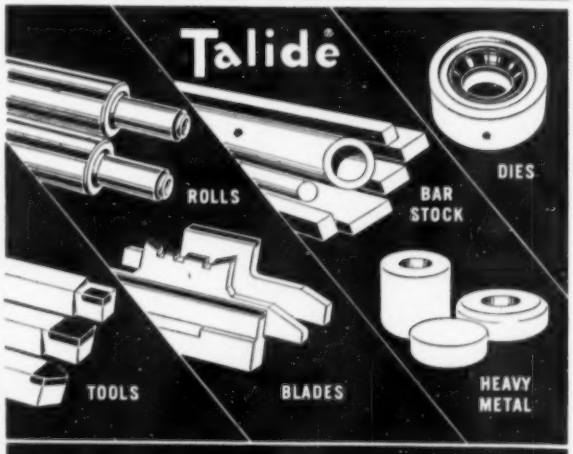


HARDEST MAN-MADE METAL!

• New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

USE READER SERVICE CARD; INDICATE A-2-270-3

Make your own comparison of the

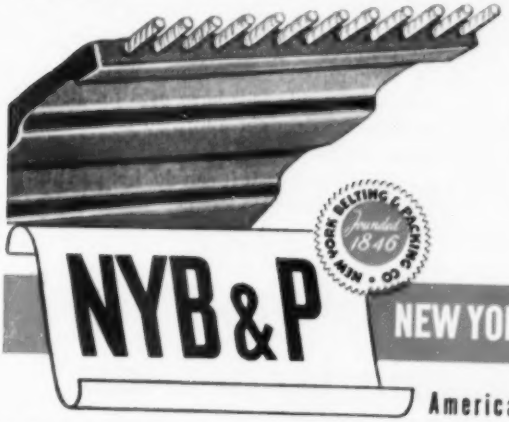
Gilmer THE ORIGINAL "TIMING" BELT DRIVE

versus other forms of Power Transmission

	GILMER "TIMING" BELT DRIVE	FLAT BELTS	CHAIN	V BELTS	GEARS
1. Can it transmit 1/100 to 300 HP without slippage . . . and without lubrication?	Yes				
2. Does it eliminate noise and vibration caused by metal-to-metal contact?	Yes				
3. Does it operate at maximum efficiency, indefinitely, without take-up?	Yes				
4. Does it make possible very compact, short-center drives of ratios up to 15-to-1?	Yes				
5. Does it eliminate need for initial tension, permitting all the drive's tension to be used effectively . . . and reducing bearing wear?	Yes				
6. Can it operate satisfactorily at peripheral speeds above 12,000 FPM?	Yes				
7. Does it maintain constant angular velocity?	Yes				
8. Is its weight very low in proportion to its strength?	Yes				
9. Does it make possible precise "timing", without appreciable backlash, between two or more widely separated shafts?	Yes				
10. Does it eliminate the expense and added weight of lubricants, lubricating devices and covers?	Yes				
11. Does it save so much power as to sometimes permit use of lower-powered motors?	Yes				
12. Does it have unusually long, maintenance-free service life?	Yes				

WHEN PLANNING A DRIVE, CONSIDER ALL FIVE!

NEOPRENE-ENCASED, CABLED STEEL WIRE GIVES THE BELT GREAT STRENGTH WITHOUT BULK



Naturally, these questions are phrased to emphasize the unique *combinations* of features provided by the "Timing" Belt drive. Question 1, for example, might have been divided into two separate questions. But this would not point up the important fact that the "Timing" Belt drive is the *only positive drive requiring no lubrication.*

Certainly, the four older types of drives will always have their special places in the power transmission picture. The important fact is that the plant engineer, like the design engineer, now has at his disposal a *fifth* type of drive ideally suited to so many applications that more than a million are now in use. Write, or ask your NYB&P Distributor for your copy of the Gilmer "Timing" Belt Stock Drives Manual. You will find him listed in the yellow pages of your phone book.

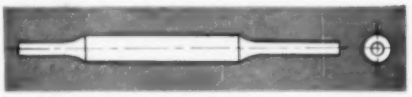
NYB&P — NEW YORK BELTING & PACKING CO. (Founded 1846) 1 Market St., Passaic, N. J.

America's Oldest Manufacturer of Industrial Rubber Products

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-271

How much are you paying for the machine that isn't there?

Because a Torrington Rotary Swaging Machine shapes work by reduction instead of cutting metal away, many parts you are now machining can be *swaged* in less time, using less material.



Take this steel shaft, originally produced by turning. By using a smaller blank and *swaging* both ends (in 9 seconds), a 37% material saving was realized. Accuracy to ±.001" was secured with unskilled labor!

You can put many operations on a Torrington Swager—pointing, tapering, reducing, sizing, forming inside contours and threads. In a short time, your swaging machine will have paid for itself. If you operate screw machines you cannot afford to be without a Torrington Rotary Swaging Machine.

See for yourself what swaging is and what it can do. Let us show you our new, 20-minute, full-color film on swaging. And write for our catalog on Torrington Rotary Swaging Machines now.

THE TORRINGTON COMPANY • Swager Department
444 North Street, Torrington, Conn.

TORRINGTON ROTARY SWAGING MACHINES

Ruggedness and Refinement

These two things you might not expect to find combined in one tool. You will find both, however, in GTD-AMPCO End Mills.

The precision finish of the shanks, the uniformity of the cutting teeth, the exactness of size assure accuracy in use. Design, steel selection and precisely controlled heat treating give them their ruggedness.

AMPCO TWIST DRILL DIVISION

GREENFIELD TAP and DIE CORPORATION

Greenfield, Massachusetts

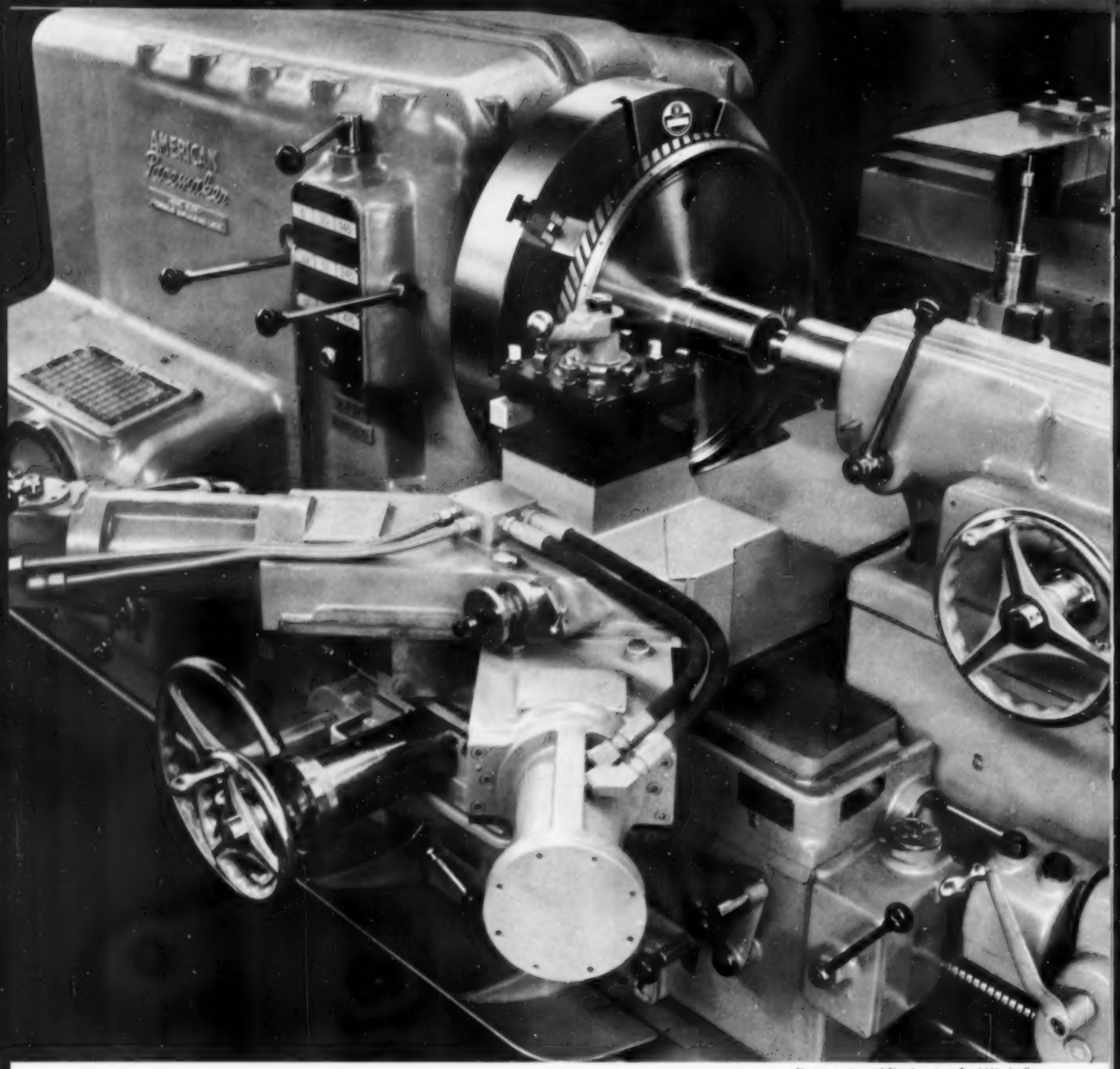


Photo courtesy of The American Tool Works Company

THE LATHE — *American Pacemaker 25" Style "G" Hydraulic Duplicating Lathe*

THE OPERATION — *Machining a jet engine compressor wheel*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

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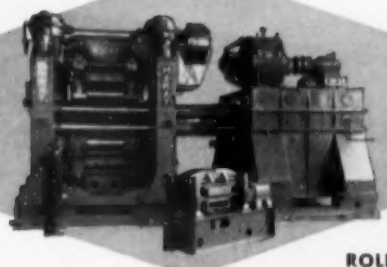
Since 1851
CHUCK

Call Your Horton Distributor Now!

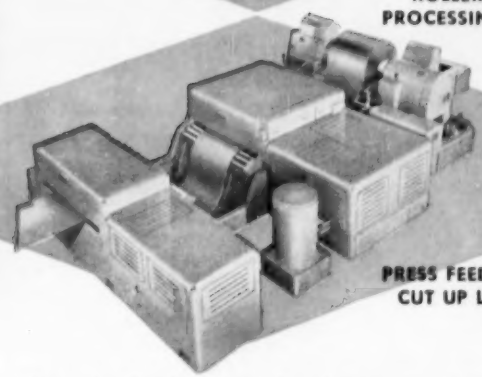
A Study in Size

TUBE MILLS AND
FORMING MACHINES

DRAW BENCHES
BAR AND TUBE



ROLLER LEVELERS,
PROCESSING MACHINES



PRESS FEED AND
CUT UP LINES

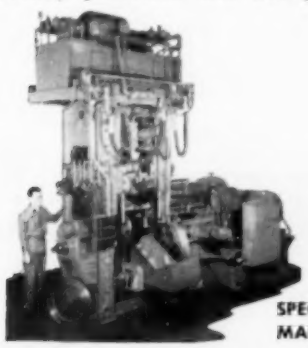
Metal working Automation in action...

If you're in the metal working business, you should be acquainted with McKay *automated* lines available for many metal working operations.

McKay pioneered and has played a leading role in the development of such equipment as that pictured on this page.

Basic McKay designs can be modified, or special machines developed to meet specific requirements.

THE McKAY MACHINE CO., YOUNGSTOWN, OHIO



SPECIAL
MACHINERY

EPOCAST

A Study in Size...

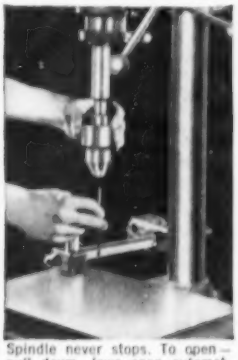
Plastocast Company of Downey, Calif. fabricated this large stretch die utilizing an aluminum pre faced with EPOCAST 4B.

Through proper formulation, quality tooling materials are available from Furane Plastics, Inc.

Whether your problem is facing large stretch press dies or spanking dies, laminating, or preparing large castings, proven EPOCAST compounds and experienced tool engineer service are available to you.

furane plastics
INCORPORATED
4516 Brazil Street, Los Angeles 39, California

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-2-276-1



Spindle never stops. To open—pull down. Jaws open automatically, release tool. To close—insert new tool. It's locked and centered. The greater the load, the tighter grip.

Model A—capacities from ¼" to ⅜" and ½" to ½" available with Nos. 1, 2 and 3 Morse Taper Shanks and Taper Adapters.

Save Time: CHANGE TOOLS IN SECONDS, SAFELY!

Drill, ream, counterbore with one spindle, without stopping spindle or moving work.

No keys, collets or wrenches are needed on Wahlstrom Fully Automatic Chucks and Tapping Attachments. Tool is automatically centered. Grip can't slip or chew tool shank. Wahlstrom Chucks convert 95% of lost tool changing time to productive time. And, a single Wahlstrom Chuck does the work of several spindles. Write for spec. folder and distributor name. Wahlstrom Chucks—made by the makers of the Float-Lock Industrial Vise.

Another AMF Product
WAHLSTROM AUTOMATIC CHUCKS

AMF TOOL DIVISION
AMERICAN MACHINE & FOUNDRY COMPANY
224 Glenwood Avenue, Bloomfield, New Jersey

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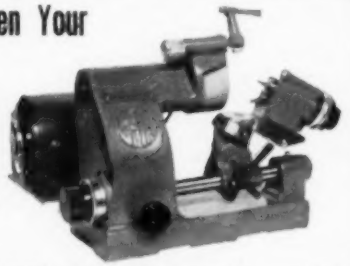
Precision Sharpen Your Die-Sinking Cutters on an ALEXANDER Bench Grinder!



Over 1,000 sold in United States

Also 2- and 3-dimensional pantograph engraving machines
Write for catalog D on these quality, British machines

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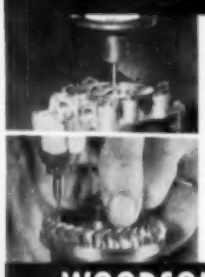
150-28 HILLSIDE AVE.
JAMAICA 32, N.Y.

USE READER SERVICE CARD; INDICATE A-2-276-3

MICRO-MINIATURES



SPECIALISTS IN THE MANUFACTURE OF SMALL END MILLS GROUND FROM SOLID

When you think of small END MILLS — think of MICRO MINIATURES

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Write for Catalog

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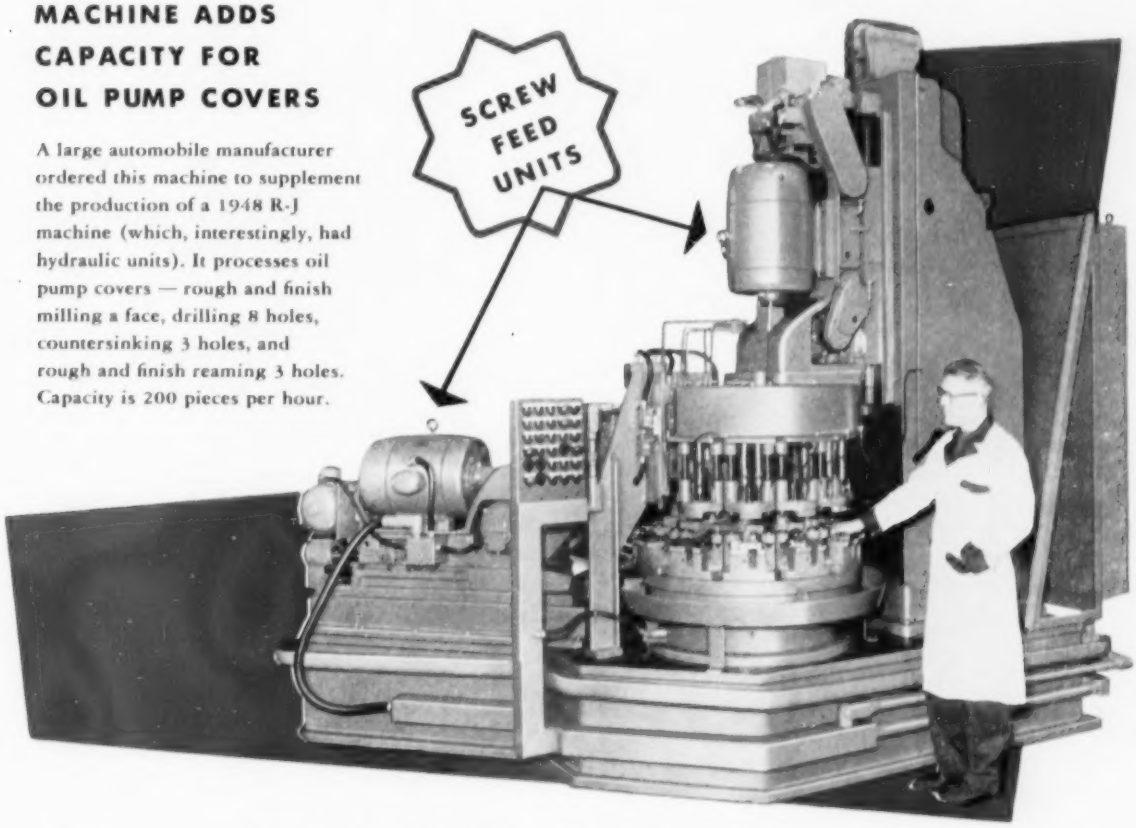
REHNBERG-JACOBSON

SCREW-FEED UNITS PROVE WORTH; "SPECIFIED" ON NEW MACHINE...

Rehnberg-Jacobson ALL-MECHANICAL Screw-Feed Power Units were carefully investigated by the potential purchasers of this machine — with the result that they *insisted* the Units be included. These Units later proved to be important factors in the final (and favorable) consideration. In many other instances, R-J Screw-Feed Units have shown that they are rugged, reliable, and — most important — *easily understood* by service and maintenance people. These Units operate on the well-proved feed screw principle, with separate motors driving differential nuts to obtain the desired approach, feed, dwell, and rapid return. An accurate and fast-acting brake is included to insure precise ending of the fast return. As can be seen from the picture, the Unit frame is large enough to carry a husky spindle-drive motor, and the face plate will hold a large multiple-spindle head. *For full details and specifications, write for literature.*

MACHINE ADDS CAPACITY FOR OIL PUMP COVERS

A large automobile manufacturer ordered this machine to supplement the production of a 1948 R-J machine (which, interestingly, had hydraulic units). It processes oil pump covers — rough and finish milling a face, drilling 8 holes, countersinking 3 holes, and rough and finish reaming 3 holes. Capacity is 200 pieces per hour.

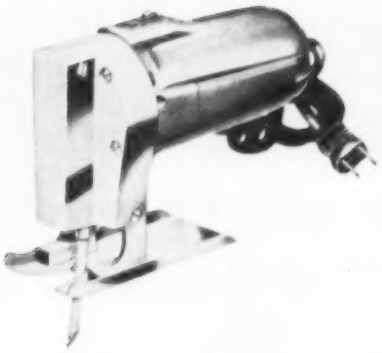


Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY

2135 KISHWAUKEE ST.

ROCKFORD, ILLINOIS



JOIN WITH HANDY & HARMAN SILVER BRAZING FOR PERMANENT PROFIT

Joint area is hand-fluxed with HANDY FLUX after which ½" piece of 1/16" EASY-FLO 45 wire is placed on top of joint area. Alloy cost is one half cent per joint.

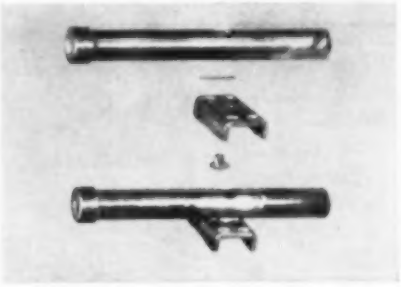
Assemblies are placed between resistance-heating electrodes which serve also as a jig. Operator applies current with foot pedal. Melted EASY-FLO 45 penetrates joint area quickly and easily. Assemblies are then given rapid quench to preserve hardness of cross-slide and to remove HANDY FLUX easily. Time required for complete cycle: 22 seconds. This lady brazes from 1200 to 1500 assemblies per day.

EASY-FLO 45 Solves Problems of Strain and Abuse

In this case, the strain and abuse are centered on the cross-slide joint of a bayonet power saw drive shaft. Made by Wen Products, Inc., Chicago, Illinois, for the do-it-yourselfer as well as the professional, this powerful tool operates at 2650 load strokes per minute and is expected to stand up to considerable strain and abuse throughout its lifetime.

The problem to be permanently solved was that of joining the steel cross-slide piece (.005 case hardened) to the drive shaft. The solution . . . silver brazing with EASY-FLO 45. A simple silver brazed joint assures all the strength this part will ever need. And the people at Wen Products were sure of it when they tested the part in this manner: After brazing, it was placed in a vise and the cross-slide piece was struck at right angles with a hammer. It was completely mangled before it was torn from the shaft. Thousands of these saws are in use today and there is no record of this joint *ever having tailed* in service. That says a lot for silver alloy brazing . . . with EASY-FLO 45.

One of the beauties of silver alloy brazing is that it can join a wide variety of metals with the same excellent results and at remarkably low cost. Whatever you are making of metal, whether joints are involved *or not*, it will pay you to investigate EASY-FLO brazing. We will be glad to explain the benefits of simplified design made possible by modern silver brazing techniques —and how these advantages can be profitably applied to your production requirements. Just call us.



GET THE FACTS OF EASY-FLO

BULLETIN 20 tells you why high strength, speed and economy are inherent in EASY-FLO brazing. Also gives Handy information about joint design and fast brazing methods. We'll be pleased to send you a copy.

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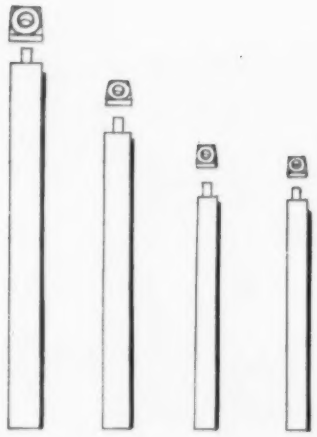
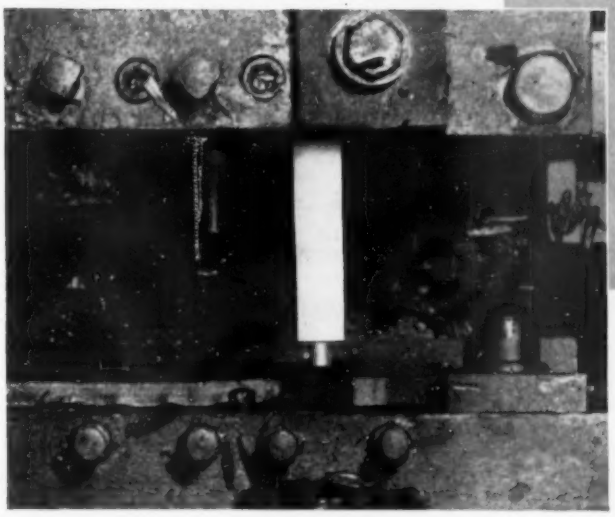


A-L CUSTOMER FINDS SAGAMORE PUNCHES BEST IN TOOL-COST STUDY



Looking down on the SAGAMORE high speed cold nut punch in horizontal press.

An A-L customer tested various tool steels to determine the best for his varied cold-punching operations. SAGAMORE, a new air-hardening, non-deforming die steel was the ultimate choice. Here's why:

- Using SAGAMORE cold-drawn stock eliminated the need for finish-grinding the punches.
- Punches of SAGAMORE outperformed those of carbon-vanadium steel three to one.

The SAGAMORE punches were hardened by heating in a salt bath to 1750F. and air cooled. They were then given a double draw at 1110F. The resulting Rockwell hardness was 51C.

Characteristics of A-L SAGAMORE are: Excellent non-deforming properties, unusual toughness, lower hardening temperatures, and easier machining and grinding. These, plus the comparatively low cost, make it a good selection for this type of application.

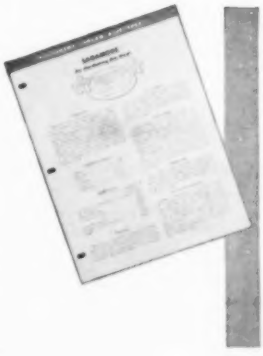
For assistance with your tool or die steel problems, call your local A-L representative or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For nearest representative, consult Yellow Section of your telephone book.

Write for your SAGAMORE BLUE SHEET

This four page report was compiled from data collected in laboratory and field tests. Included is complete information on applications, physical characteristics, forging, annealing, hardening, tempering, etc. *Ask for your copy.*

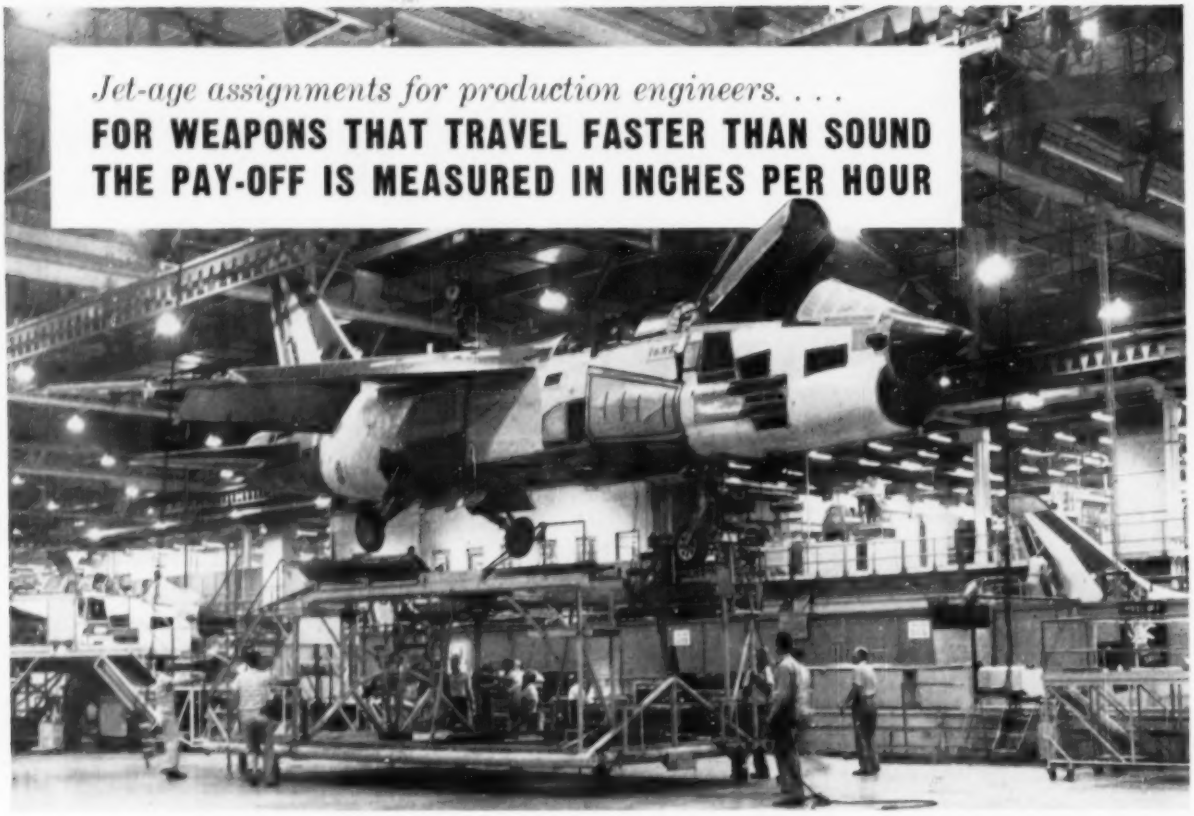
ADDRESS DEPT. TE-86



For complete **MODERN** Tooling, call

Allegheny Ludlum

AL FINE TOOL STEELS SINCE 1854



Jet-age assignments for production engineers. . . .

FOR WEAPONS THAT TRAVEL FASTER THAN SOUND THE PAY-OFF IS MEASURED IN INCHES PER HOUR

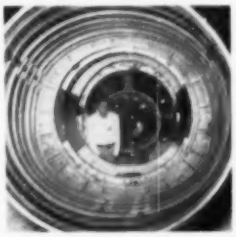
Production time is as important as operating speed in the development of complex aerial weapons. This is a consideration that's built into Chance Vought's missiles and fighters. From the time they are conceived, *producibility* is a determining factor in their development. This is due largely to the influence of Vought's production engineers. Their work begins in Preliminary Design, where they translate initial drawings into an efficient manufacturing pattern. From then on their influence is continuous — in material selection, fabrication methods, shop loading and quality control. In fact, it's a production engineer who issues final company approval of every Vought weapon.

For a first-hand look at our manufacturing opportunities, arrange now for a personal interview at Chance Vought. Or, for a confidential report on our openings, write to:

Al Sterling, Supervisor
Employment and Placement

For quality control engineers, tool engineers, manufacturing control engineers, industrial engineers . . .

Vought is a laboratory for new production techniques. Here, production engineers explore new fabrication methods for titanium, honeycomb and other revolutionary materials. They are finding new capabilities for precision tooling, and they are writing procedures for some of industry's most advanced chemical, mechanical and electronic projects.



Dallas is a growth center for modern industry. Some 2,000 different firms have manufacturing plants in Dallas alone. Dallas and Fort Worth form one of the nation's largest and fastest expanding aircraft and electronics manufacturing complexes. Family as well as corporate advantages are spurring industry's move to Texas. Here, home-building and living costs are low, and sales taxes, city and state income taxes are non-existent.

CHANCE VOUGHT AIRCRAFT
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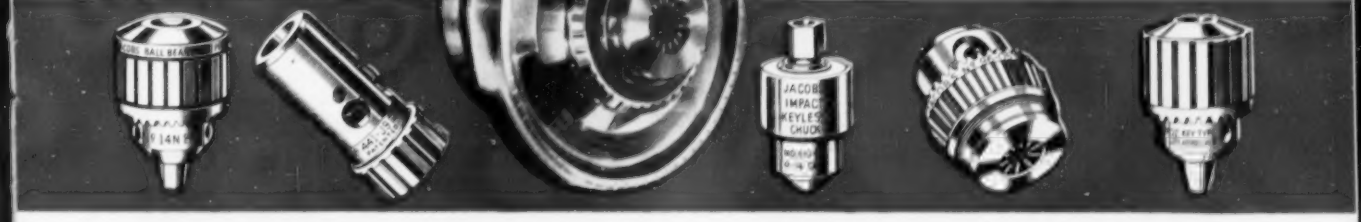
Jacobs
CHUCKS

Accuracy in performance is achieved by accuracy in production of every component part.

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

The Jacobs Manufacturing Company
West Hartford, Connecticut



The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

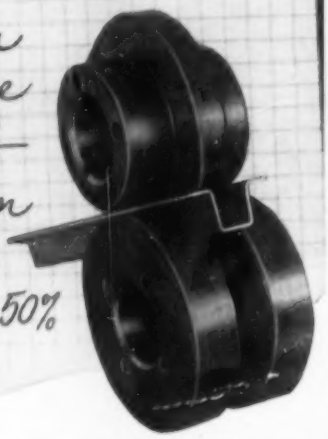
The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

Are you stamping or rolling shapes like these?

Hi-Den can reduce your tool-fabrication time by as much as 50%



A large aircraft manufacturer* reports HI-DEN rolls in a Yoder machine produced these short-run parts in stock sheared from sheet aluminum (in as-quenched condition) more satisfactorily and economically than other methods tested. And *tool fabrication time was reduced* 50%.

Another company* found that a steel draw die which formerly required three passes to complete a draw, when faced with HI-DEN completed the same draw in one pass. HI-DEN *treats the metal better.*

More than 100 different applications for HI-DEN have been reported by users . . . forming, stretch, draw and press brake dies; jigs, fixtures, templates, pressure pads and many others. Ideal for use in Hydro-form or Mar-form presses.

HI-DEN, a compreg of selected wood veneers impregnated with phenolic resin (laminated and compressed under extreme heat and pressure) is far stronger than equal weight in steel, is lighter in weight, easier to handle, resistant to oil, alcohol and moisture, dimensionally stable — and is easily shaped with standard tungsten carbide tools.

**Names on request*

If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs?

P.S. HI-DEN's companion product, Parkwood 8000 (a kraft paper impregnated laminate) is becoming popular for bench tops . . . smooth, hard, but resilient, it won't burr and scratch assemblies of aluminum alloy and other softer metals.

Parkwood Laminates, INC.

32 Water St., Wakefield, Massachusetts

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TOGGLE CLAMPS
35 Types & Sizes

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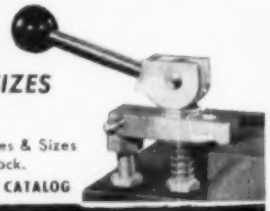
15 STYLES . . . 136 SIZES



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take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

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DIVISION OF UNION TWIST DRILL COMPANY

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FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE 1-2-283

LINDBERG INDUCTION UNIT IMPROVES HEAT TREATING PROCESSES AT J.I. CASE...

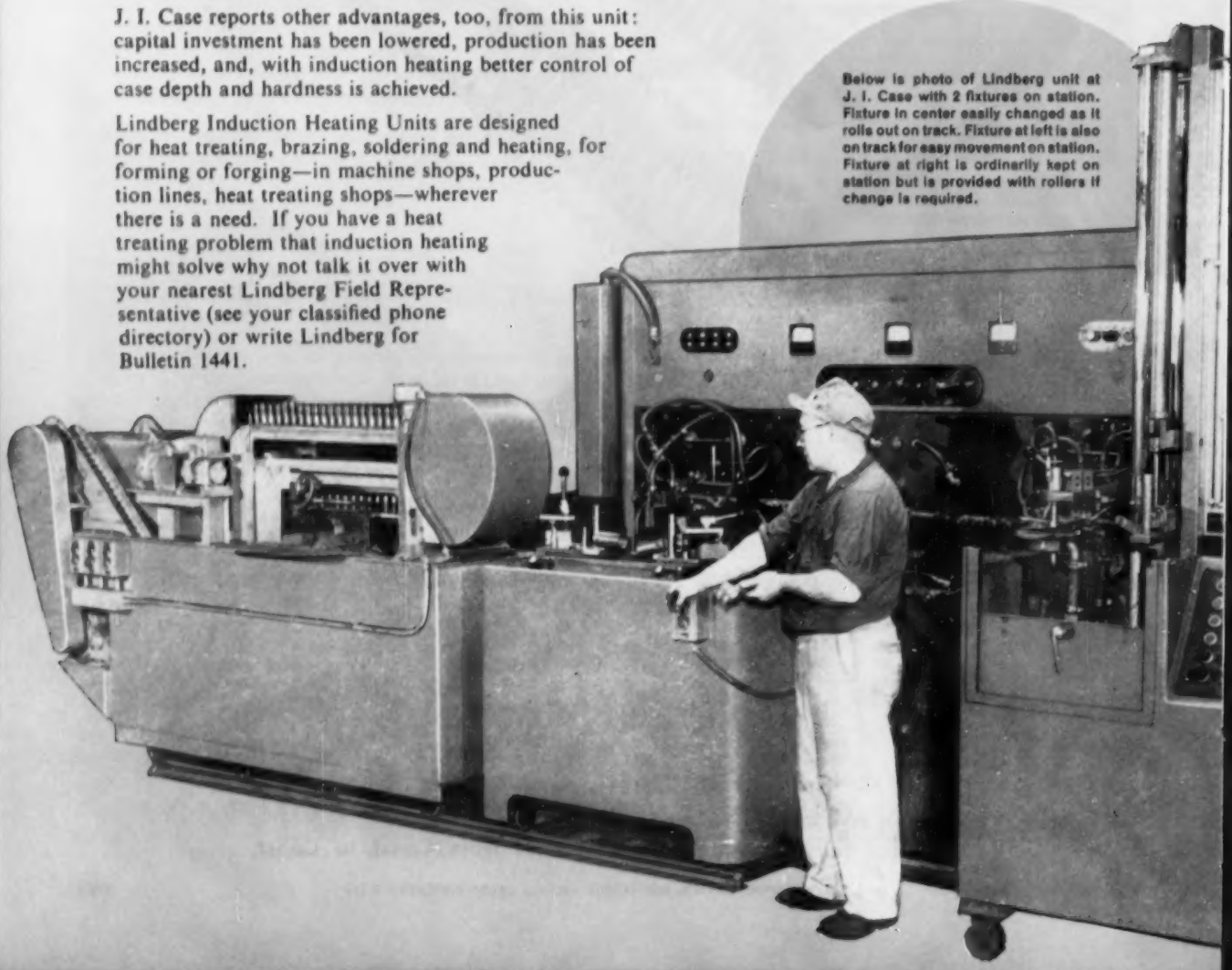
SAVES ½ ITS TOTAL COST— *IN 1 YEAR!*

A single Lindberg 2-station High Frequency Induction Heating Unit at J. I. Case Co., Racine, Wisc., is providing a happy combination of sizeable cost savings and improved quality and production efficiency in heat treating parts for Case tractors. Actually, the dollar savings effected with this Lindberg unit will repay its total original cost in *less than 2 years!*

This single unit and the five work fixtures provided with it, working on 2 to 3 shifts, 5 days a week to meet production requirements, heat treat some 63 separate tractor parts. Work fixtures are readily changeable, set-up time is materially reduced, and because of the 2-station design, the unit can operate continuously while work fixture is being changed over on one station.

J. I. Case reports other advantages, too, from this unit: capital investment has been lowered, production has been increased, and, with induction heating better control of case depth and hardness is achieved.

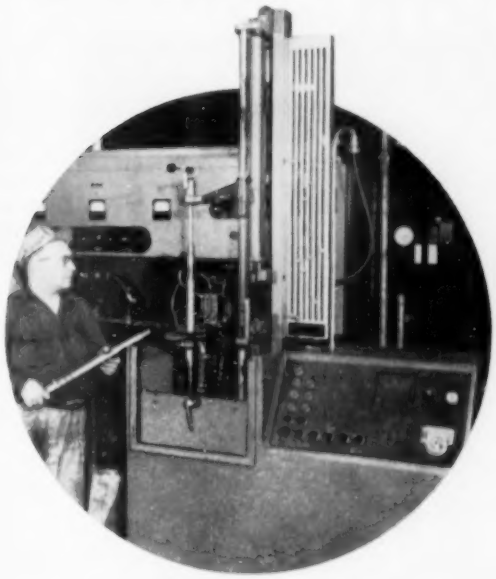
Lindberg Induction Heating Units are designed for heat treating, brazing, soldering and heating, for forming or forging—in machine shops, production lines, heat treating shops—wherever there is a need. If you have a heat treating problem that induction heating might solve why not talk it over with your nearest Lindberg Field Representative (see your classified phone directory) or write Lindberg for Bulletin 1441.



Below is photo of Lindberg unit at J. I. Case with 2 fixtures on station. Fixture in center easily changed as it rolls out on track. Fixture at left is also on track for easy movement on station. Fixture at right is ordinarily kept on station but is provided with rollers if change is required.

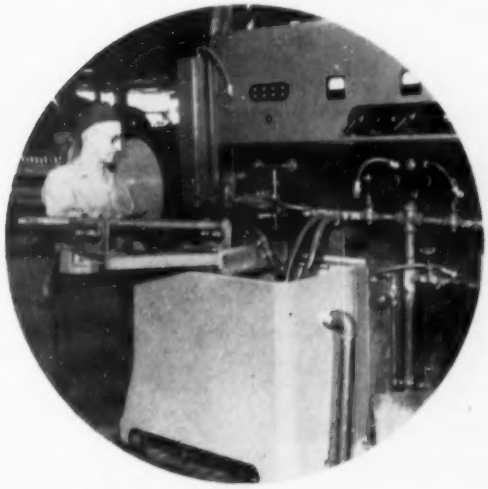
(Above) Hydraulic male coupling is being treated on this fixture. 3 other parts are treated by it, too.

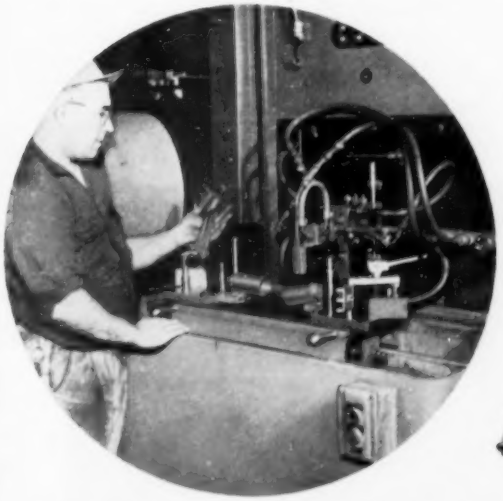
(Below) This fixture is shown selectively hardening a front axle king pin. It handles piece up to 45½" long, 35" of which can be scanned to desired depth. It is also used for 34 other parts.



(Below) Power take-off hydraulic drive shafts are one of the 3 parts treated by this fixture.

(Above) This shows fixture handling inlet and exhaust valve rocker arms. Same fixture treats 6 other parts.





(Above) This fixture is selectively hardening pads and slots on shifter forks. It is also used for treating 17 other parts.

LINDBERG
HIGH FREQUENCY DIVISION
Lindberg Engineering Company
2447 West Hubbard St., Chicago 12, Ill.

UNBRAKO STRIPPER BOLTS NOW AVAILABLE WITH THE NYLOK* SELF-LOCKING DEVICE

UNBRAKO STRIPPER BOLTS with the Nylok self-locking device. Nylon pellet locks them with positive, dependable prevailing torque action. Bolts are reusable.

Self-locking UNBRAKO stripper bolts (shoulder screws) save time, money and headaches wherever they are used. They eliminate the costly, time-consuming checking of bolts to see that they are securely tightened. They protect precision tools and dies from damage caused by vibration-loosened bolts. They assure that your equipment will have longer service life, with reduced maintenance and downtime.

UNBRAKO stripper bolts are manufactured to the highest standards of precision. They are made of heat-treated alloy steel with continuous grain flow lines and have fully formed Class 3A threads finished close to the shoulder for maximum strength and holding power. Shoulders, held to fine tolerances, are concentric with heads and threads for uniformly accurate fit. The tough, resilient, *permanent* nylon locking pellet is integral with the threaded section.

All standard UNBRAKO socket screw products are available with or without the Nylok self-locking device. Authorized industrial distributors stock them. Write us for catalog and technical data on the complete line. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

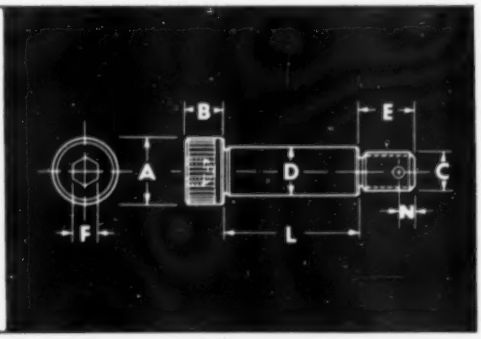
SPS

JENKINTOWN PENNSYLVANIA

SELF-LOCKING UNBRAKO STRIPPER BOLTS fasten this stripper plate securely. Constant vibration, shock, extended running time will not cause these bolts to loosen.

SPECIFICATION DRAWING. UNBRAKO stripper bolts are available with standard shoulder lengths ranging from ⅛ to 6 in.

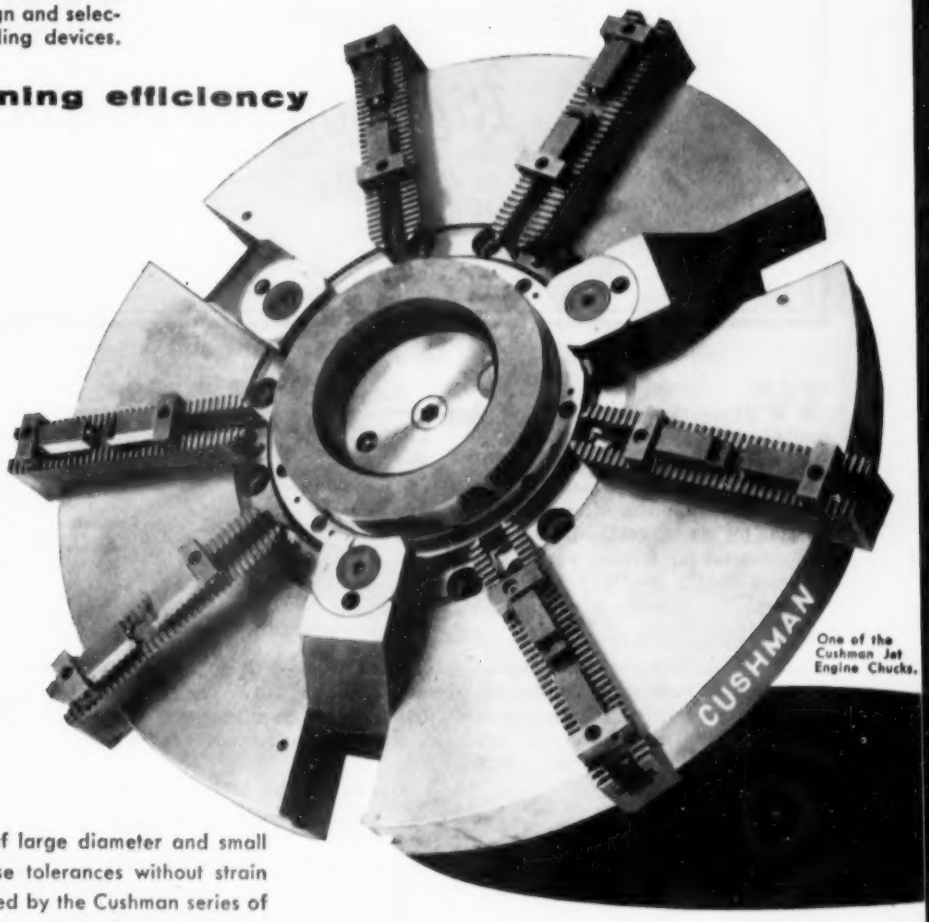
D	Shoulder Diameter*	¼	5/16	⅜	½	⅝	¾
C	Thread Diameter UNC	10—24	¼—20	5/16—18	⅜—16	½—13	⅝—11
E	Thread Length	⅜	7/16	½	⅝	¾	⅞
A	Head Diameter	⅜	7/16	9/16	¾	⅞	1
B	Head Height	5/16	7/32	¼	5/16	⅜	½
F	Size of Hex. Hole	⅛	5/32	3/16	¼	5/16	⅜
N	Pellet Location	.141	.172	.187	.203	.234	.281
	*Shoulder Diameter Tolerances Max.	.249	.3115	.374	.499	.624	.749
	*Shoulder Diameter Tolerances Min.	.248	.3105	.373	.498	.623	.748



CUSHMAN chucks give Chuck-ability

CHUCK-ABILITY — The ability to SPEED your work . . . ELIMINATE fatigue . . . IMPROVE your products . . . and REDUCE your costs . . . through design and selection of the right work-holding devices.

the key to machining efficiency



One of the Cushman Jet Engine Chucks.

Efficient machining of jet engine parts of large diameter and small cross-section to extremely close tolerances without strain or distortion was materially improved by the Cushman series of special chucks designed and built for this purpose. These chucks completely overcome the inherent difficulties of the operations and permit mass production of these vital component parts. The success of these new chucks is one more proof that Cushman gives **Chuck-ability** as an essential to efficient production.

Manufacturers throughout the country have long recognized and used the Cushman Engineering Department for solutions to chucking problems. We invite you to use this experienced service.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut
a world standard for precision

CUSHMAN CHUCKS . . . *A Product of American Quality, Labor and Materials*

SEE YOUR INDUSTRIAL DISTRIBUTOR

manufacturers of:

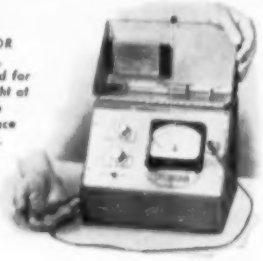
Air Operated Chucks, Cylinders, and Accessory Equipment . . . The Cushman Power Wrench . . . Cushman Manually Operated Chucks and Face Plate Jaws.

Undetected Machining Costs Can Lie Right on the Surface

Walking through your plant, it would be hard to see the needless costs hidden in undermachining or overmachining. These unnecessary costs can only be computed after parts are rejected by the inspection department and returned for further work . . . *or accepted with a costlier finish than required!*

Economy in surface finishing depends on machining to exact specifications. Whenever a surface is machined more or less than required, money is wasted. To avoid this requires accurate surface finish measurement *at the machine.*

Up to now, finish has been judged at the machine by looking or feeling.



The new Brush SURFINDICATOR provides a fast, accurate method for determining right at the machine the degree of surface finish produced.

This need not exist any longer, for a portable tool has been devised that makes accurate surface finish checking a simple matter, *anywhere in the plant.*

New Tool Eliminates Finishing Losses

The Brush SURFINDICATOR* is an easy-to-carry surface finish measuring device that can be used by any worker wherever needed—for in-process checking of surface smoothness. With this new tool, it is possible to meet optimum specifications without wasting material, time or money.

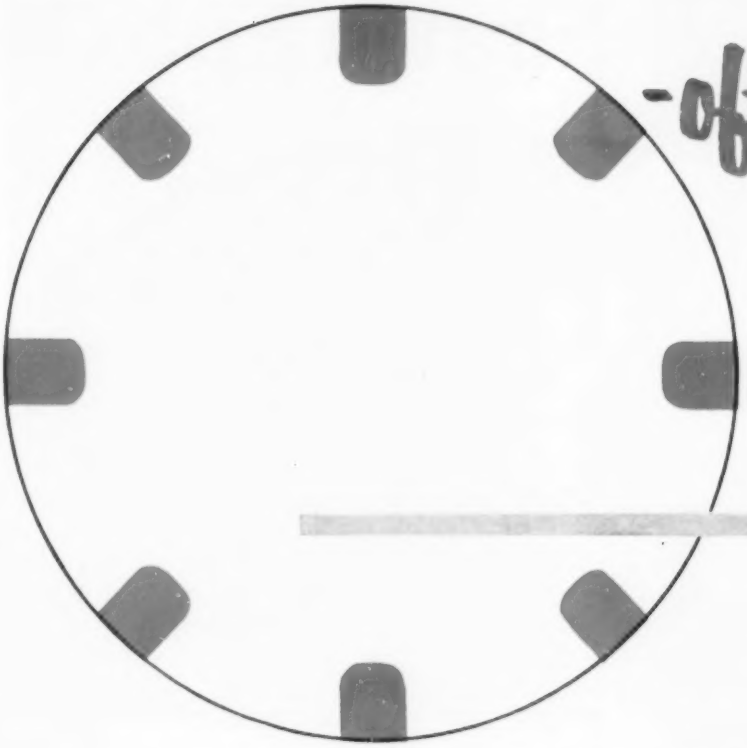
The operation is simple. A hand-held stylus is stroked over the surface that is to be measured. A direct reading is obtained in microinches, and the worker or inspector immediately knows the exact surface finish already produced. Not limited to one material, the SURFINDICATOR can be used on metals, glass, plastic, paper, wood and other surfaces for maximum finishing economy.

Both the new ASA Standards and the complete Brush SURFINDICATOR description are contained in this booklet. Send for your copy now.

Find out all about this new portable tool that produces savings by preventing finishing waste in your plant. The full story is told in the informative Surfindicator booklet. Also included are the new ASA Standards on surface finish for industrial use. Write for your copy today. *TM

BRUSH ELECTRONICS COMPANY
3504 Perkins Avenue, Cleveland 14, Ohio
BRUSH ELECTRONICS
DIVISION OF CLEVITE CORPORATION

SIMPLE WAY TO CUT MACHINING COSTS

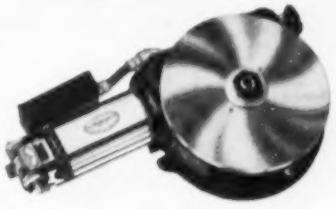


-often in half!

Suppose it takes x-seconds to machine a part. 3x-seconds to get the part to and from the machine tool. Cut 1x-second off handling time—you've cut machining costs in half.

Obvious, you say.
The trick is how.

Here's one way: Install a Bellows Rotary Work Feed Table. Your operator loads at one station while machining goes on at a second, parts are ejected at a third. The table is adjustable to position 4, 6, 8, 12, or 24 stations. It is air-powered electrically-controlled. The ten inch diameter table top can be drilled and tapped for mounting jigs and fixtures or for mounting oversize table tops. The table can be synchronized to the movement of drill press spindles or press rams. It is inexpensive to buy, inexpensive to install and can be readily moved from one machine to another. Simplest way you ever saw to save money in many machining operations.



Write for these free booklets

Describes the full line of Bellows Rotary Work Feed Tables and Bellows Index Tables: permissable loads, positioning speeds, positioning accuracy. Ask for Bulletins RT-1022 and RT-1326. Address Dept. TE-257 The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

The Bellows Co.

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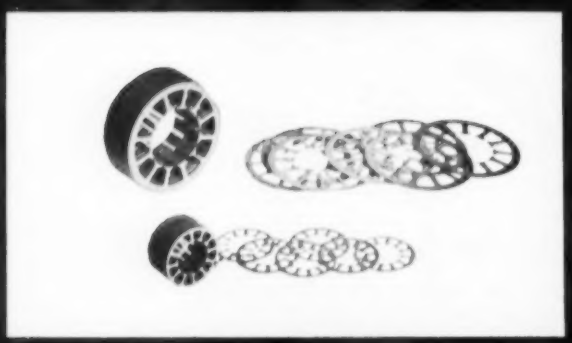
Formulator: Emerson & Cuming, Inc.
Customer: I.T.E. Circuit Breaker Co.

Precision...In Miniature!
High bond strength and excellent electrical properties of Araldite Epoxy Resins make possible the design and production of this chatter-less stator.
Formulator: Rubber & Asbestos Corp.
Customer: Kollsman Instrument Company.



Whether your use of Araldite Epoxy Resins would be for coating, tooling, electrical, adhesive or laminating applications, formulations based on Araldite Epoxy Resins can meet your requirements exactly. The excellent adhesive, mechanical and chemical properties of Araldite Epoxy Resins, plus their versatility, make them "a natural" to promote design improvements and save time and money on the production line. Here are two of the many instances where Araldite Epoxy formulations provided the right answer to large and small scale design problems.

The Technical Services of Ciba's Plastics Division are the finest in their field. For full information on how Ciba Araldite Epoxies lead to product development and production improvements, write...

Ciba Araldite Epoxy Resins come with the assurance that they have met not only our rigid PRODUCTION qualfiy control standards but the specific APPLICATIONAL requirements of the user as well.

Ciba produces basic resins only, to be formulated for intermediate and end uses.

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CIBA COMPANY INC., Plastics Division
Kimberton, Pennsylvania

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Please send me full information on CIBA Epoxy Resins for

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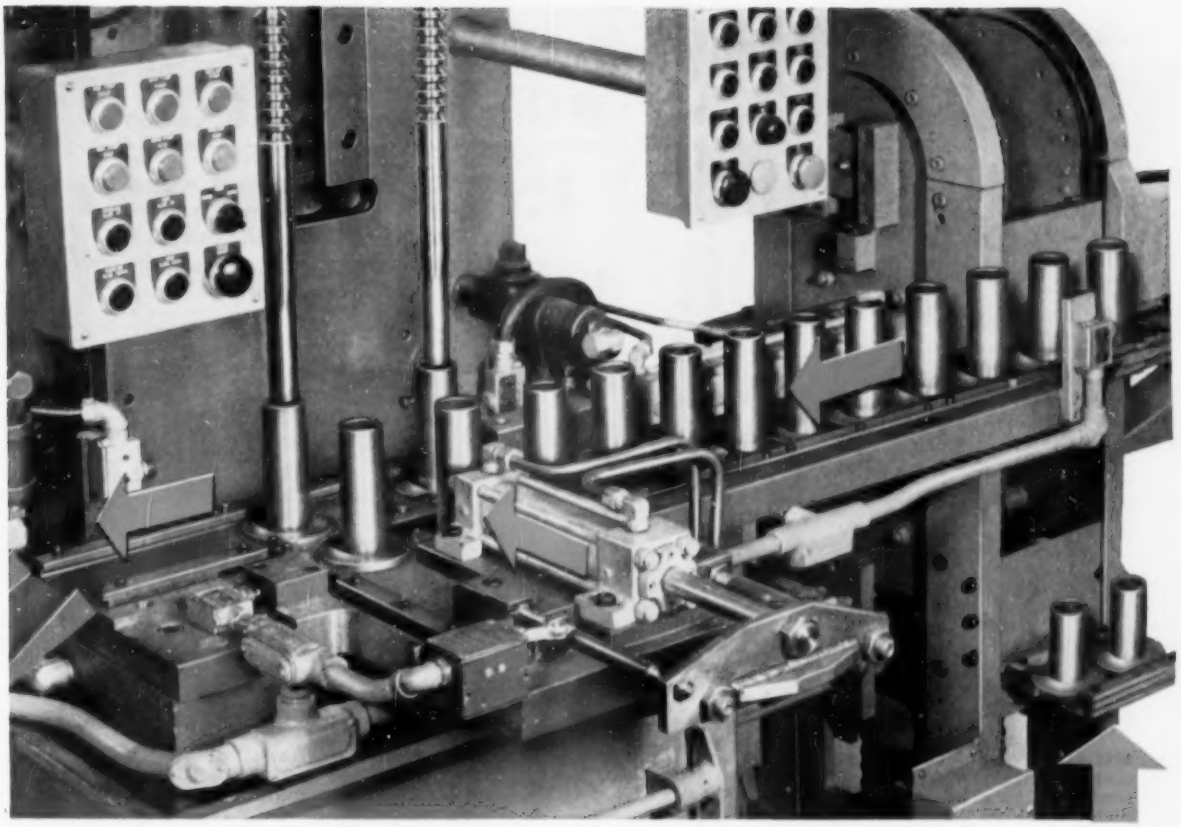


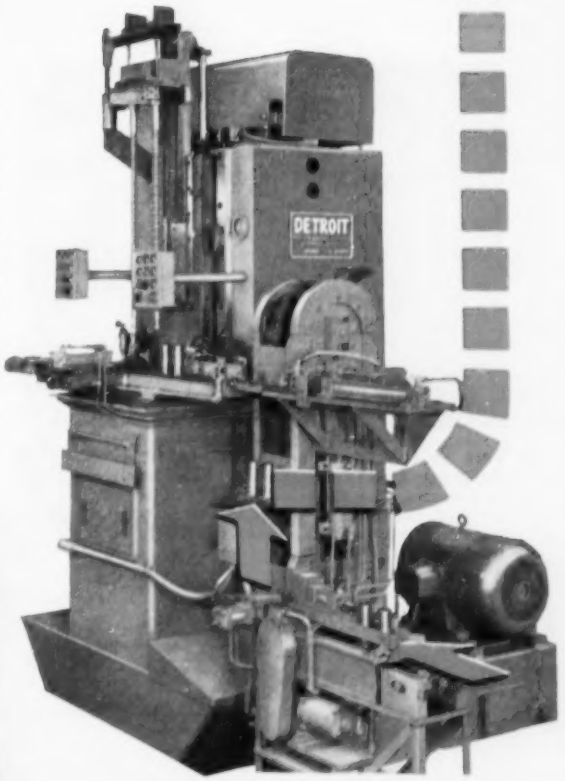
STANDARD Broaching Machine Tooled for AUTOMATION

This broaching setup on a Detroit 15-ton, 42-inch Vertical Pull Down Machine illustrates *practical* automation! It combines the economy of a standard machine, readily retooled for production changes, with a special work handling system that makes floor-to-floor operation fully automatic.

Flanged work pieces are loaded at floor level, conveyed to an elevator, raised, pushed off and shuttled into broaching position, broached and unloaded . . . all without an operator. Each broaching stroke sizes the I.D. and removes excess welding at the flange joint. Parts are handled as fast as they can be supplied by the "automatics" ahead of this operation.

The same broaching specialists who created this productive combination of "standard and special" can help solve *your* production problem. Send parts, prints or details now.

Write for bulletin describing Detroit Vertical Pull Down Machines.

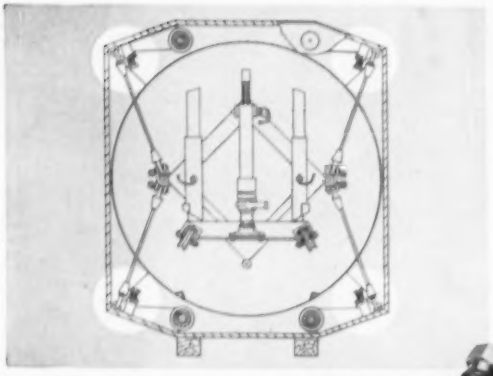


DETROIT BROACH & MACHINE COMPANY

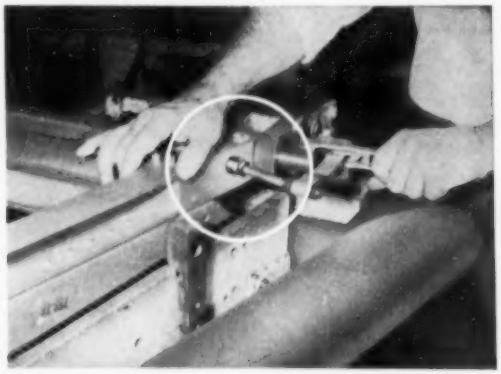
DEPT. D-2 • ROCHESTER, MICHIGAN

TOOLING IDEAS your shop can use!

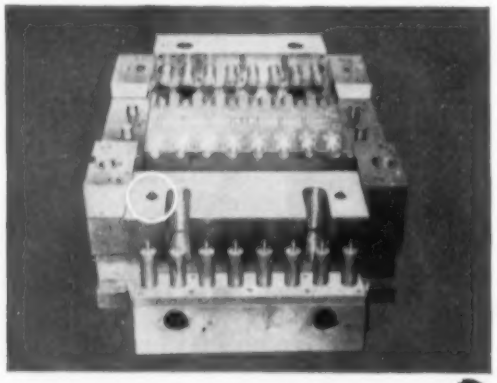
Shown below are just a few of the many uses for Vlier tooling accessories. Although these standard accessories are primarily used in jigs and fixtures, many companies are using them to replace custom-made devices in original equipment.



SPECIAL SWIVEL-PAD CLAMPS for a missile container manufacturer incorporate the remarkable Vlier ball-joint construction. Eight Swivel-Pad Clamps are used to release tension on cables which suspend the missile in its shipping container. This particular model withstands 21,000 load pounds.



CLAMPING PARTS WITH OFF-ANGLE SURFACES is no problem when Vlier Toggle Pads are used with a toggle clamp as shown here. The pad swivels 10° each side of the center line, assuring solid clamping of the part with no damage to the surface.



THIS 16-CAVITY, SIDE-ACTION PLASTIC MOLD uses four Vlier S-66 Spring Plungers as *detents* to lock the side-action bar in its travel to the center of the mold, eliminating costly, custom-made detents formerly used.

New Head Design

on all Vlier Torque Thumb Screws protects working parts from dirt, chips, and other foreign matter. Truarc ring makes disassembly easy. In all Vlier Torque Thumb Screws the ball-check is perpendicular to the screw axis, preventing uneven wear and wobble.

A glance at the new 1956 Vlier catalog will probably suggest many applications in your shop where you can standardize on Vlier accessories. Write for your free copy today.

VLIER ENGINEERING INCORPORATED

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Insist on Vlier Tooling Accessories... there's still no substitute for qual

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Because at Putnam we specialize in the manufacture of end mills, you will find more standard sizes and types listed in this catalog than can be found in any other. Thus, on nearly every milling job you will find the quick and convenient answer to your end mill requirements right in your own tool box—in the Putnam Catalog.

If you would like a copy of this catalog, see your neighbor, the local Putnam distributor—this catalog is yours for the asking.

9560

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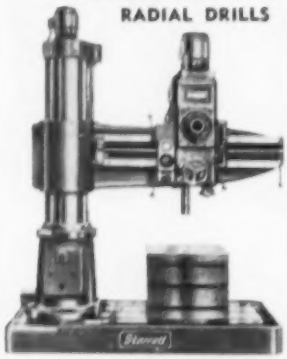

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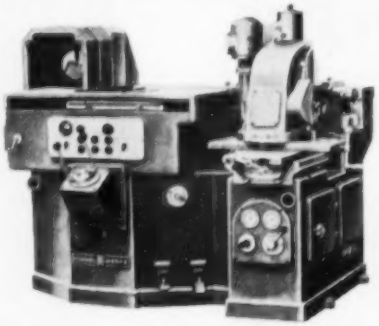

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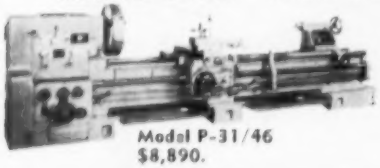

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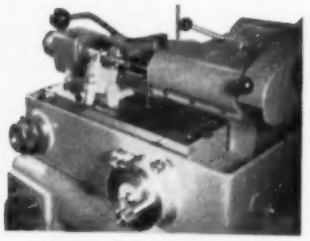

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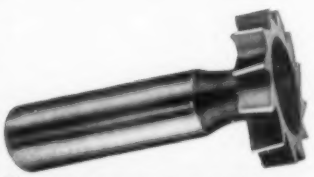

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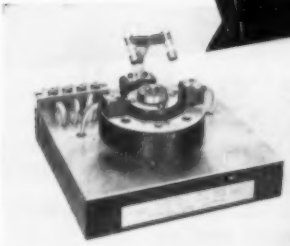

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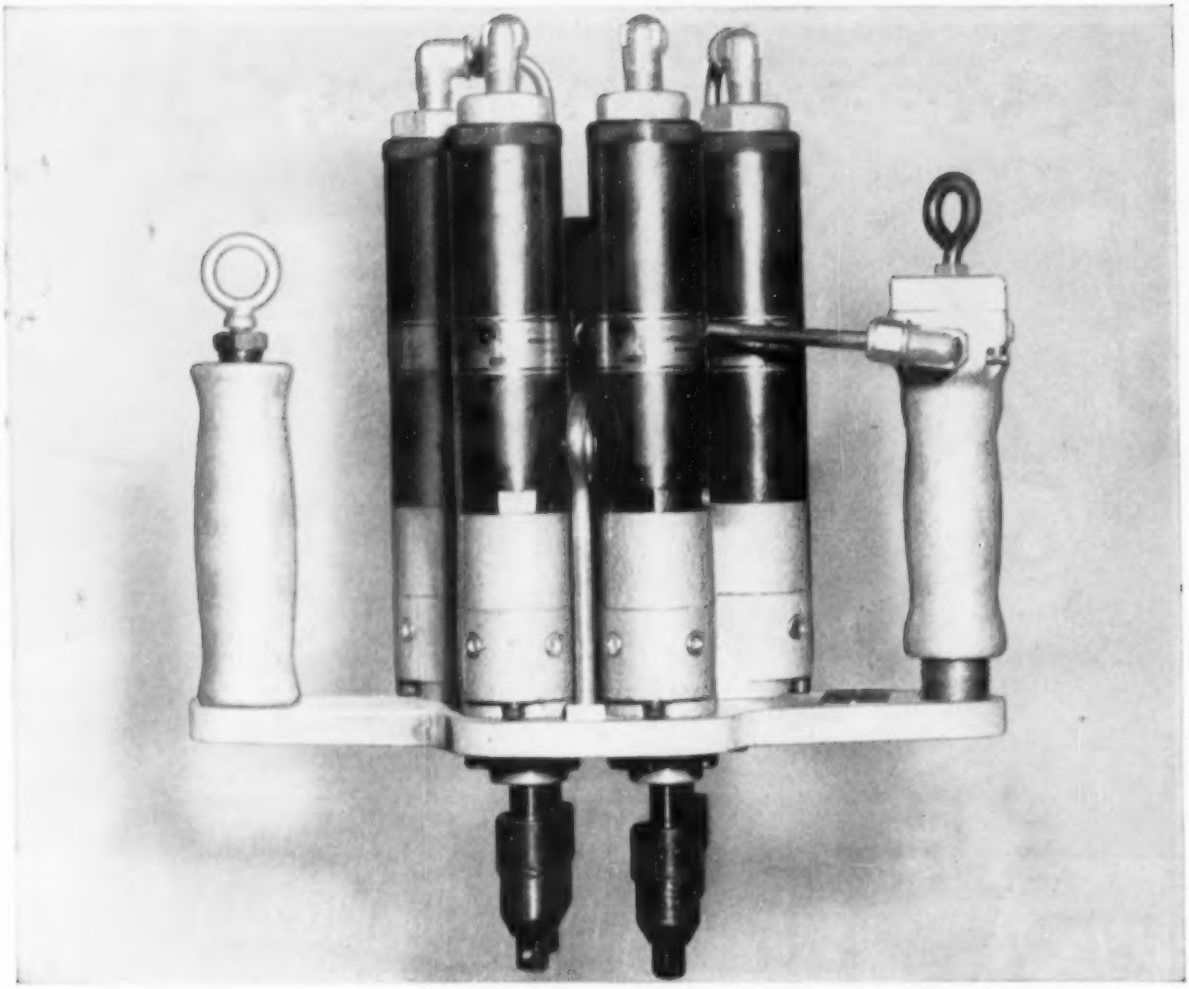

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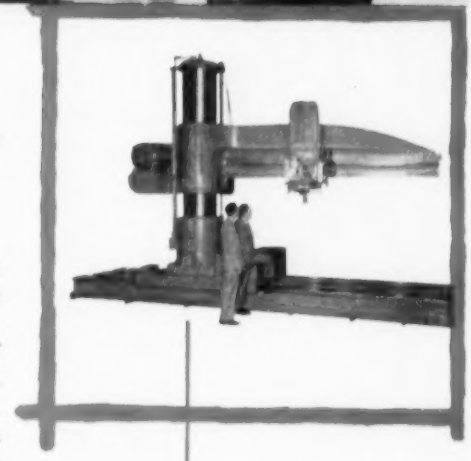

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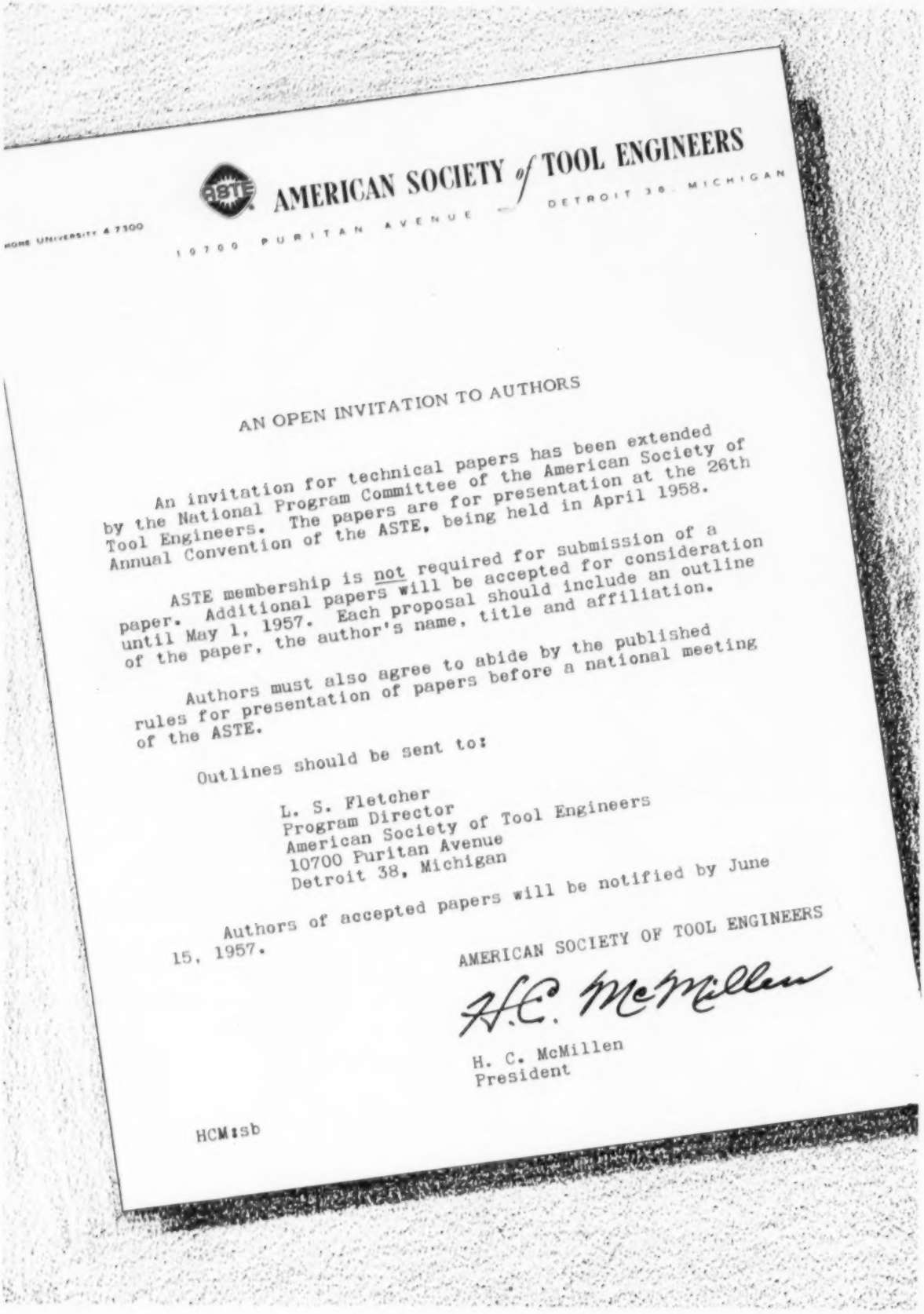

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AN OPEN INVITATION TO AUTHORS

An invitation for technical papers has been extended by the National Program Committee of the American Society of Tool Engineers. The papers are for presentation at the 26th Annual Convention of the ASTE, being held in April 1958.

ASTE membership is not required for submission of a paper. Additional papers will be accepted for consideration until May 1, 1957. Each proposal should include an outline of the paper, the author's name, title and affiliation.

Authors must also agree to abide by the published rules for presentation of papers before a national meeting of the ASTE.

Outlines should be sent to:

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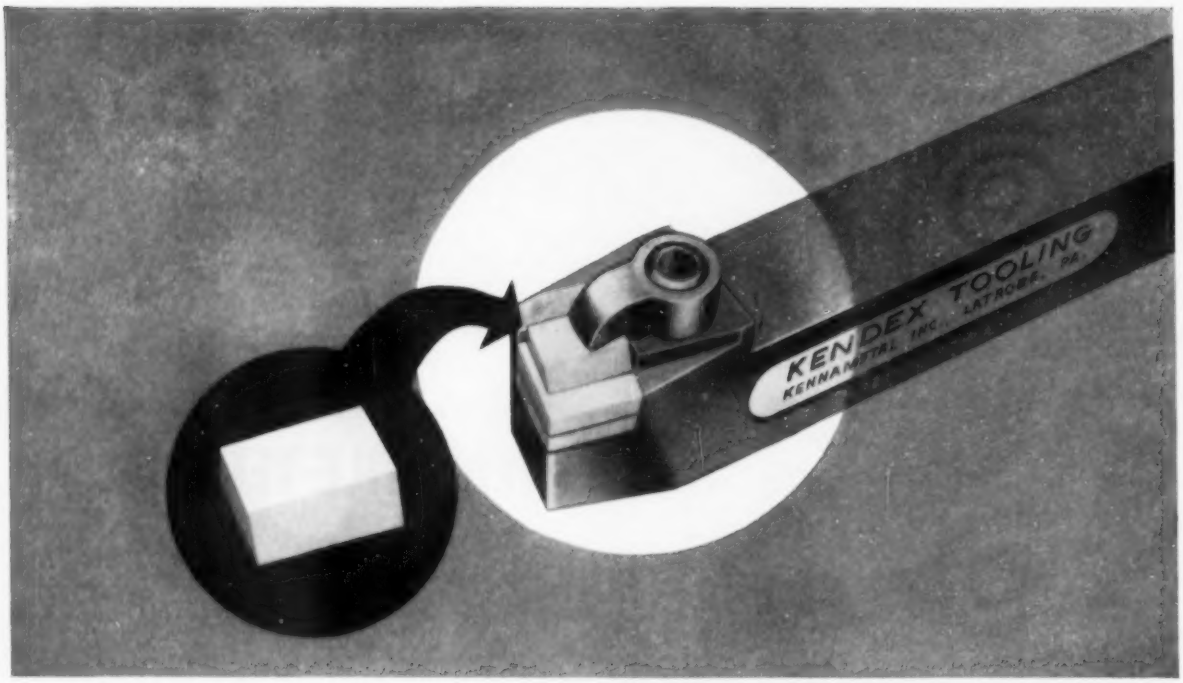

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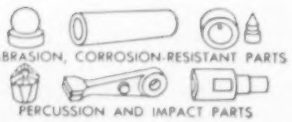

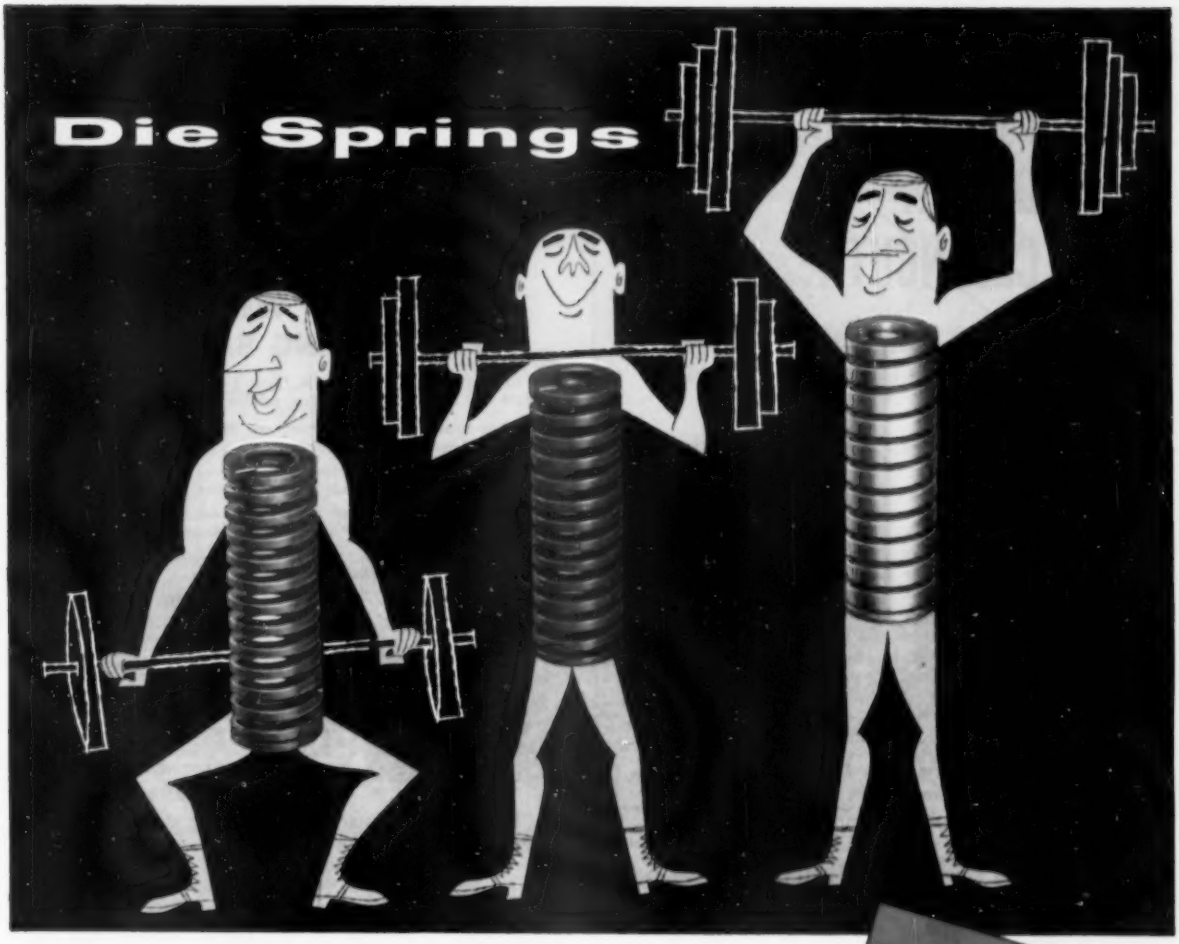

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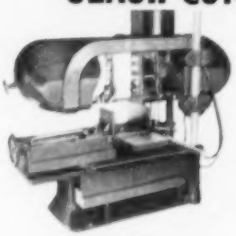

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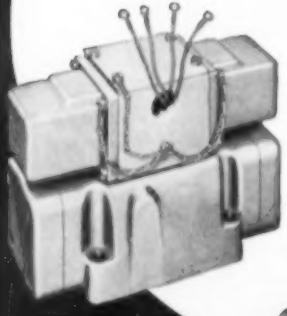

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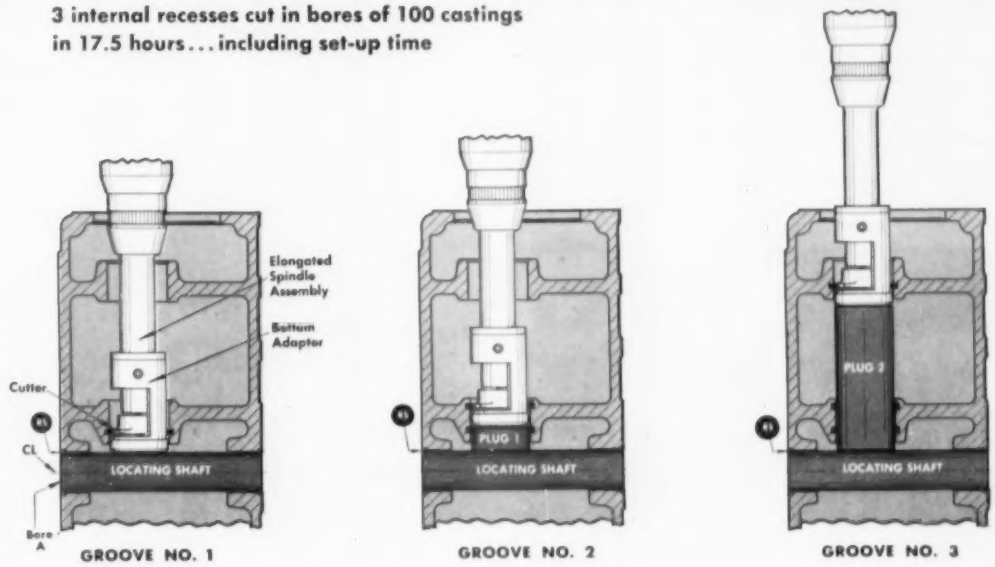
3 internal recesses cut in bores of 100 castings in 17.5 hours... including set-up time



GROOVE NO. 1 GROOVE NO. 2 GROOVE NO. 3

The job shown above called for three grooves located at prescribed distances from center-line CL of bore A. Depth and location tolerances: ±.0015".

Size and shape of the castings made nesting difficult for a boring bar operation. Exterior surfaces were unmachined, making alignment complicated. With two grooves over 7" from the housing's open end, boring bar chatter could have caused costly rejects.

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Groove No. 2: Plug 1 was inserted into the bore over the locating shaft and the tool again piloted into the bore. The groove was then cut the same way as Groove No. 1.

Groove No. 3: Plug 2 was substituted for the first plug and the cutting operation repeated.

All 300 grooves were held to prescribed tolerances. Set-up time: exactly 11 minutes. Operating time: 1050 minutes for 100 castings. Rejects: none!

No recessing problem is too tough for the amazingly versatile Waldes Truarc Grooving Tool. It's so simple even unskilled labor can use it accurately.

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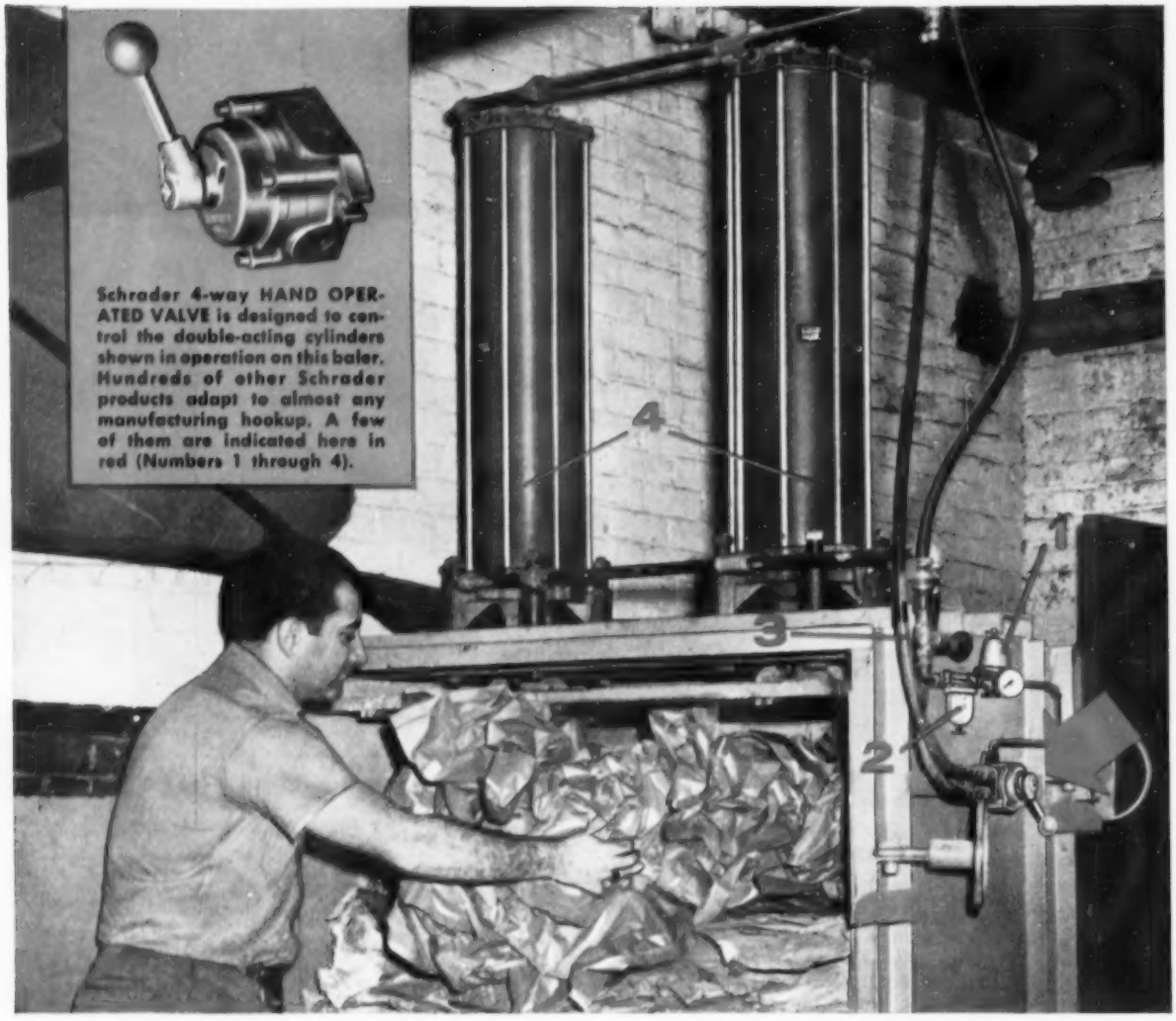
Schrader 4-way HAND OPERATED VALVE is designed to control the double-acting cylinders shown in operation on this baler. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 4).
4
3
2
1

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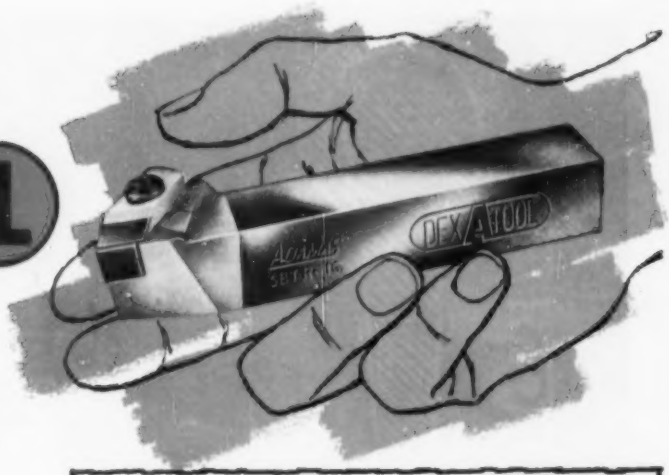
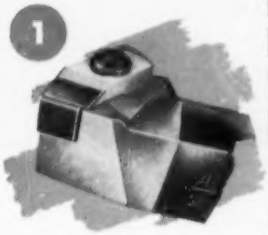


No other toolholder for "throw-away" inserts gives you as many extras-for-efficiency as DEX-A-TOOL by Adamas!

Talk about *fast* and *easy* to work with — DEX-A-TOOL's got them all beat for quick interchangeability, rapid indexing and fast, accurate chipbreaker location after indexing! And versatile? DEX-A-TOOL accommodates both "thin" (1/8") cutting tips with 1/32" nose radius *or* "thick" (3/16") carbide inserts with 3/64" nose radius!

DEX-A-TOOL's 7 styles and 56 sizes cover the full range of machining conditions! DEX-A-TOOL's precision engineering and many plus features add up to real trouble-free machining! Plan *today* to test DEX-A-TOOL on your own machines.

1



Adjustable chipbreaker

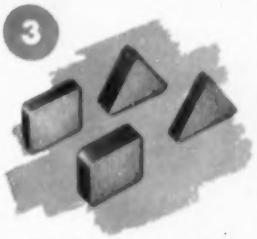
Combination chipbreaker clamp is easily adjustible for lightest to heaviest cuts . . . eliminates the need for a separate chipbreaker for varying feeds.

2

Invertible anvil

Invertible feature doubles life over other anvils . . . gives up to 8 times the life over anvils which are not indexable and twice the life over anvils which are not invertible . . . copper plated, hardened tool steel or carbide.

3



Holds both "thick" and "thin" inserts

"Thick" and "thin" anvils accommodate 1/8" or 3/16" inserts of either carbide or Ceralox (Adamas ceramic cutting tool material).

4

Chipbreaker setscrew

Provides fast, precision relocation of chipbreaker.

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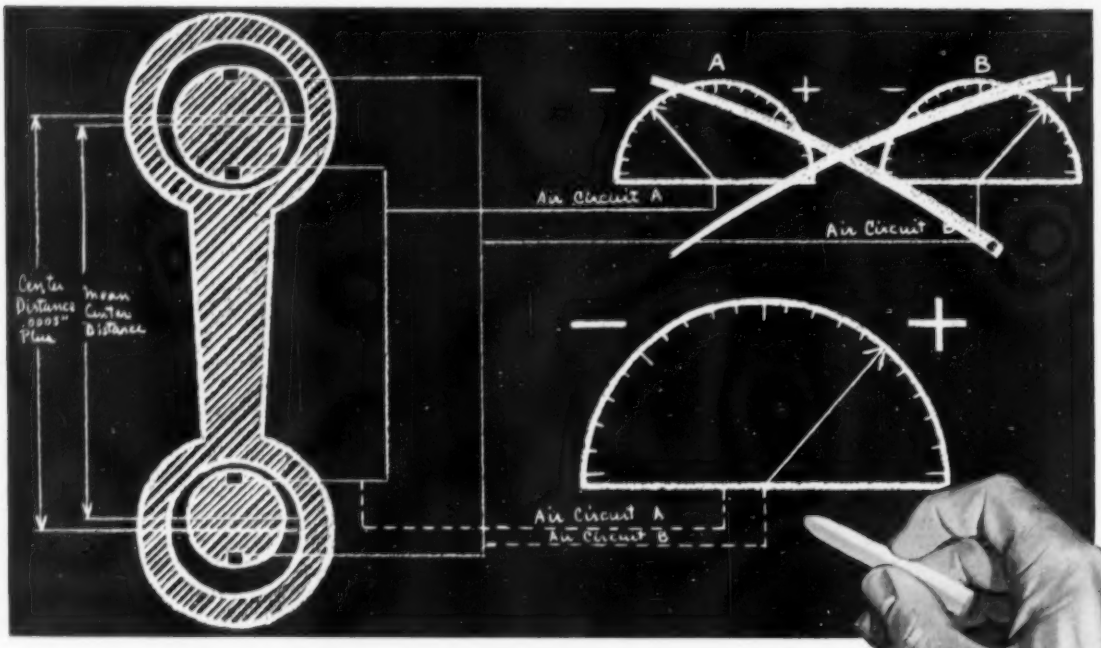

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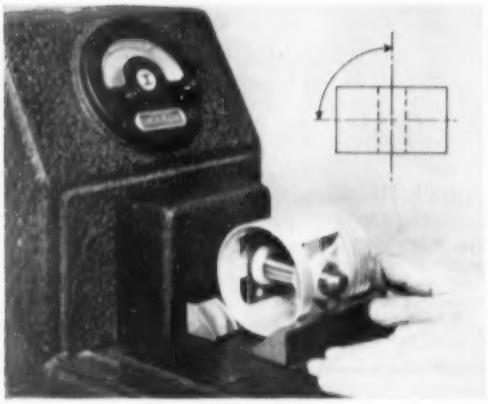

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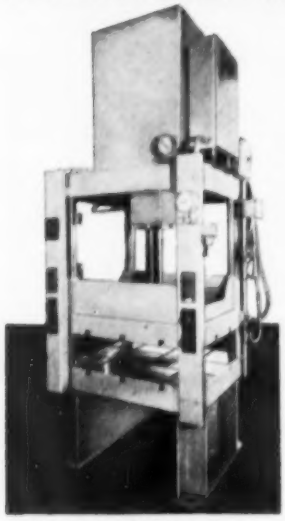

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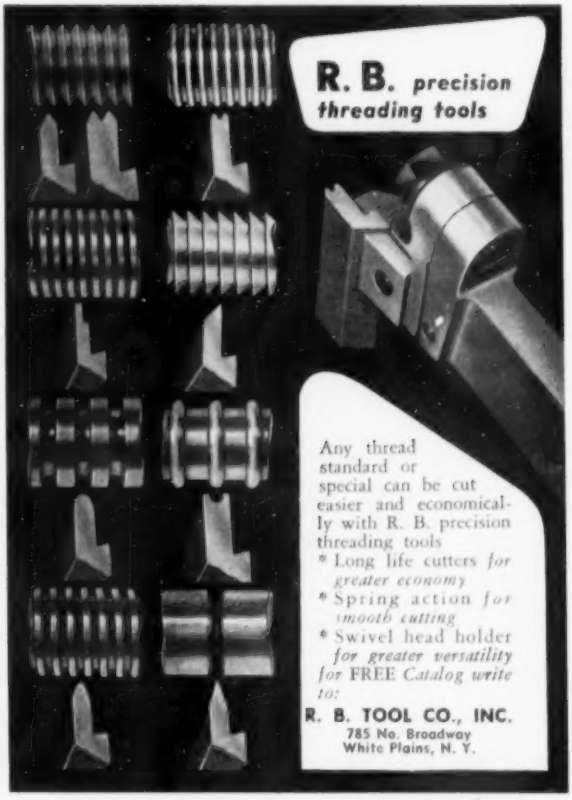
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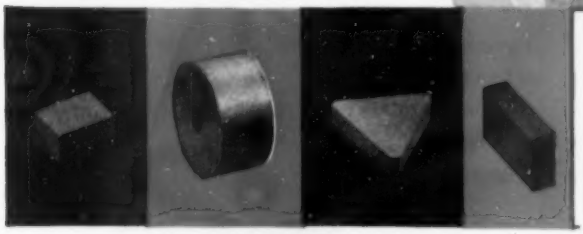

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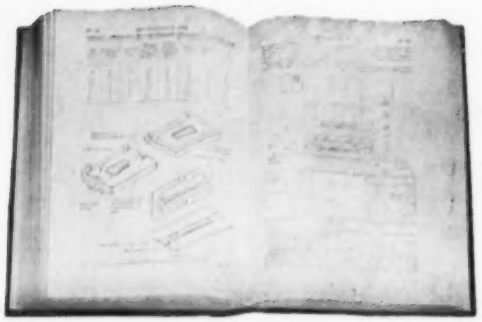

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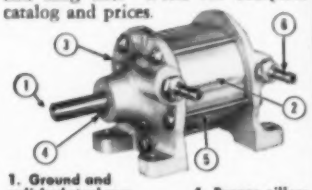

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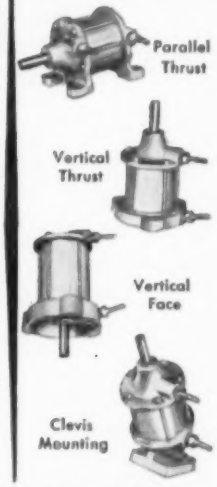

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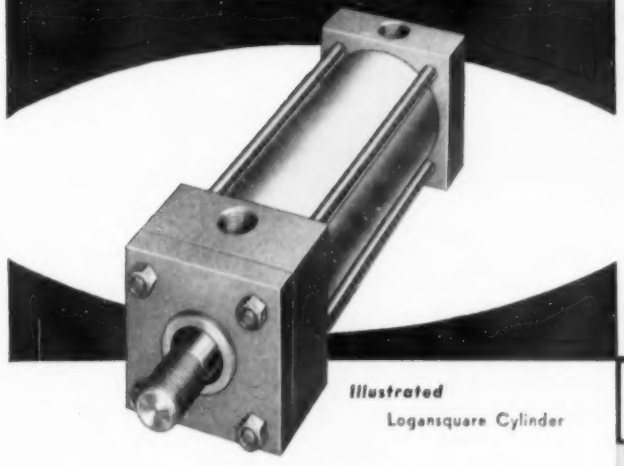

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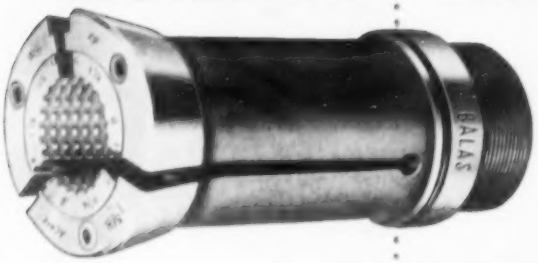

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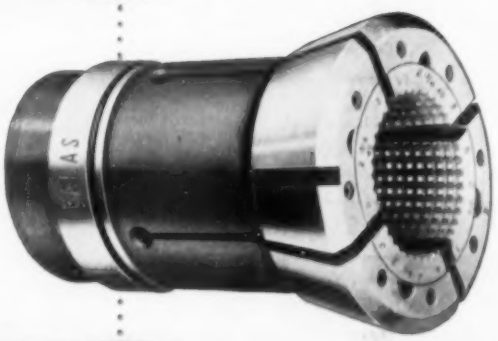

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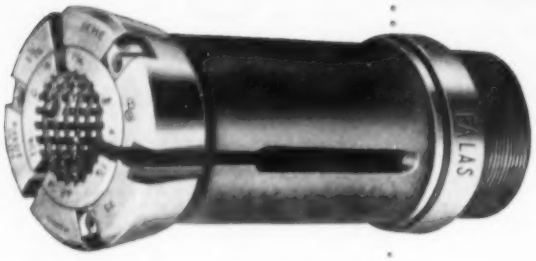

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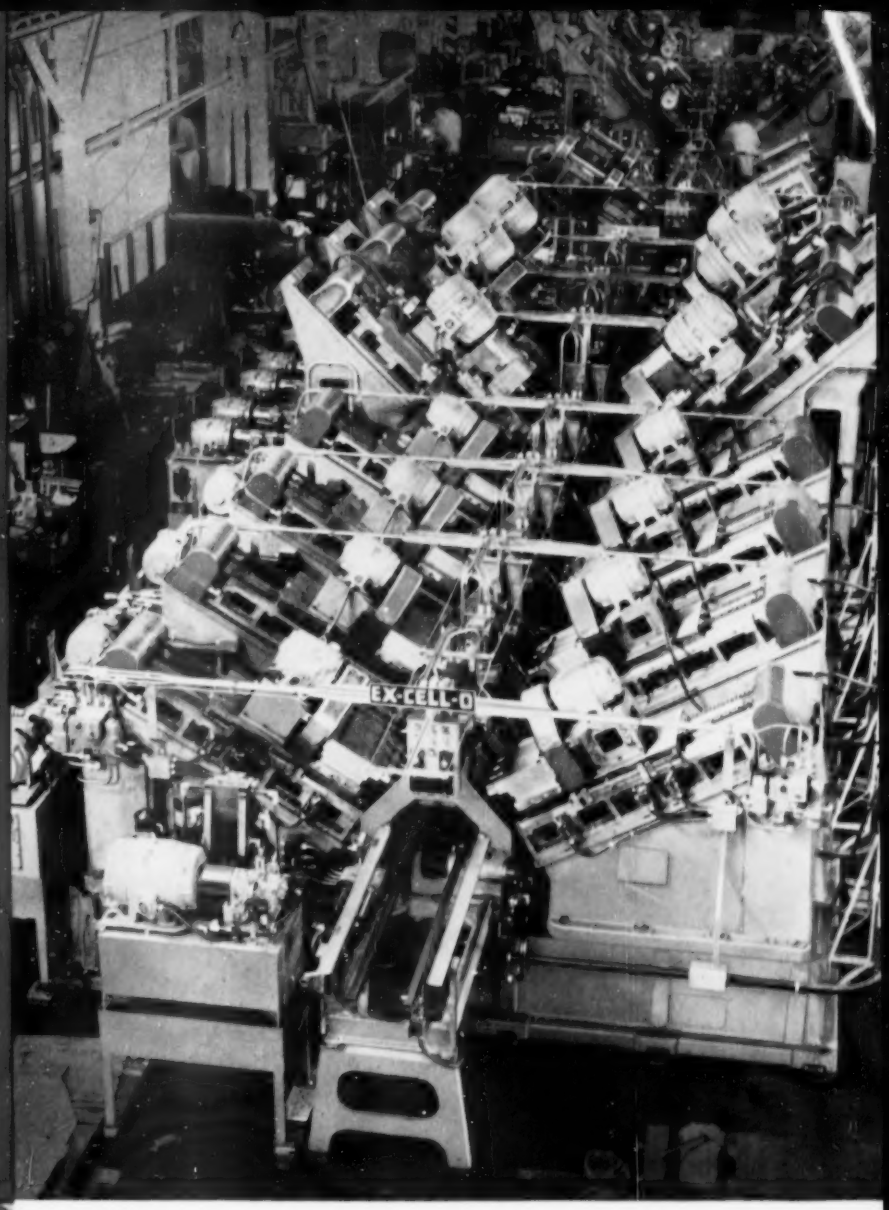

The photograph above is a view in the auto plant shortly after the automation line was installed. At right above, a portion of the line as it neared completion in the Ex-Cell-O plant.

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